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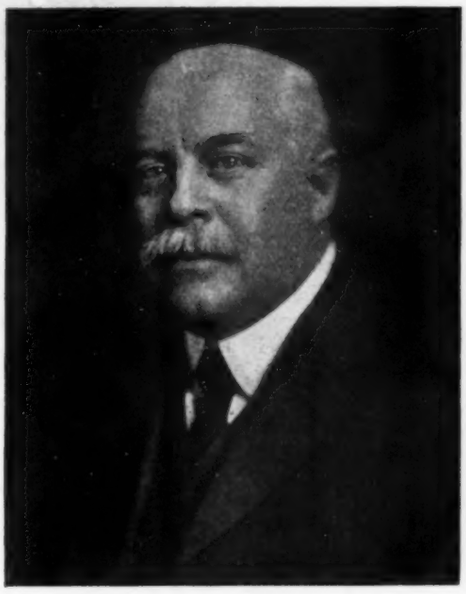


Two New National Services to Industry

Two of the most important economic tasks undertaken at the instance of Secretary Hoover are the subjects of this story of the Bureau of Standards by Dr. Burgess, its director. Neither one is exclusively a Bureau activity although each has its headquarters in the Bureau administration building. The successful completion of the work of the Federal Specifications Board and of the Dictionary of Specifications should go far to improve and simplify American purchasing methods.

By Dr. George K. Burgess
Director Bureau of Standards

WHEN the Bureau of Standards was established, no one had any conception of the wonderful developments that were to come in American industry. The need for accurate standards of length and weight was well recognized, however, and the Bureau was charged with the task of establishing such standards. The measurements that had to be taken were distinctly of a quantitative nature, and the plans and equipment for making them were not very elaborate.

At the Bureau as it exists today, accurate measurements are still made, and refinements have been instituted that are commonplace to the modern physicist, but would seem very marvelous to the early scientists of the Bureau. But, in addition, the Bureau is called upon to do a large amount of quantitative research to meet the demands of the ever-widening field of American industrial effort. A great deal of this new type of work is done for the Army and Navy and other Government departments. It is consequently difficult to find the time and means to take care of the legitimate demands of private business.

The abandonment of certain activities and the inability to comply with many requests for tests of commercial apparatus of various types naturally brings up the question as to how far the Bureau could go in doing work of this nature. The Bureau and its staff exist for the purpose of serving the people of the United States, but there are many research jobs that can better be carried on by the industries themselves, or by individual companies within the industries. It is difficult to know where to draw the line, and I shall not attempt to set down any dividing line here.

There are two comparatively new Government activities in which the Bureau of Standards is interested, and which, to my mind, hold out great possibilities for valuable service to the country as a whole. They are a direct outgrowth of the call for qualitative research into raw material and some of the simpler manufactured products, and represent the effort to systematize and simplify the facts that have been discovered.

The first of these two new services is the Federal Specifications Board, of which the Director of the Bureau of Standards is chairman, and Mr. F. S. Harriman, Engineer Physicist of the Bureau of Standards is vice-chairman. The Federal Specifications Board came into being shortly after the installation of the Bureau of the Budget in 1921. The duties of the board, as specified in Circular No. 42, Bureau of the Budget, are "To compile and adopt standard specifications for materials and services, and to bring the Government specifications into harmony with the best commercial practice wherever conditions permit, bearing in mind the desirability of broadening the field of supply."

Each Government department and establishment purchasing materials and supplies in accordance with specifications designated a representative to serve as a member of the board. The first meeting was held on Oct. 31, 1921, and resulted in the formation of an

executive committee consisting of the representatives of the ten executive departments, the Panama Canal and the General Supply Committee to provide a more compact body for the handling of the business of the board.

This is the way the board works: The need of specifications for a given article or material for either technical or business reasons is fully considered by the executive committee, and the subject is then referred to a technical committee composed of Government experts in the particular subject for consideration of all existing Government or commercial specifications. A specification is selected or written that will be suitable for the use of all departments and establishments of the Government. The co-operation and advice of interested commercial and industrial concerns is invited and their recommendations are fully considered by the technical committee. The specification as agreed on by the technical committee is then submitted to all departments and establishments of the Government through their respective representatives on the Federal Specifications Board for comment and criticism. At the same time, copies of the proposed specifications are submitted to the American Engineering Standards Committee with a request for their assistance in securing comment and criticism from the various interested engineering and technical societies all over the country. All criticisms received are referred back to the respective technical committees for consideration on their merits. When the specification is finally agreed upon, it is promulgated by the Federal Specifications Board as official Government standard for use in connection with the purchase of material covered by the specification. A specification so agreed upon is binding upon all Government departments and independent establishments.

The board now has 60 technical committees at work on such widely different subjects as lubricants, metals, textiles, wire rope and cable, coal, fire extinguishers, glassware, telephones, machine screws, bolts and nuts, thermometers and insecticides. Up to Jan. 1, 1924, 114 specifications had been adopted. The current year will see many more brought out of the technical committees and submitted to final action. At the present time, the board is not considering materials and devices of a strictly military nature.

Value of Standard Specifications

The work of the Federal Specifications Board is closely related to the general subject of standardization, and standardization of specifications is the first and most essential step in the economy that arises from the purchase of materials in large quantities. The purchase of materials in accordance with well defined standards understood and agreed upon by the purchaser and producer alike in the contract, is the only way by which materials can successfully be purchased by competitive bids. With such standards, the Government is enabled to take advantage of this method in securing the lowest price that can be obtained for an article of the required standard. Without them, the reputable bidder is not only at the mercy of the unscrupulous ones, but the Government is deprived of the legitimate economy resulting from this method of purchasing.

The suitability of an article for the service required is equally important. Otherwise, money would be wasted in the purchase of materials of a quality better than needed and great losses would result from the use of cheap but low-grade materials. The great value of specification standardization from the standpoint of the Government lies in consolidated purchases to a single standard specification for a given article. From a military standpoint, supplies can more readily be purchased in an emergency owing to standard reserve stocks in the greatly enlarged markets.

The selection of a specification or standard without due regard to the manufacturing problems involved would be equally as serious as for manufacturers to establish them without careful consideration of the needs of the purchaser. In the selection of specifications for Government use, the Federal Specifications Board is co-ordinating these two interests in a manner that is fair to and understood by both the manufacturer and the user, and will in time base all Government purchases on correct standards of quality and practice. This procedure will, no doubt, serve in time as a model to be followed by large corporations, municipalities, states and the public.

Conception of a Dictionary of Standards

The Federal Specifications Board is making satisfactory progress in standardizing the specifications by which all sorts of commodities are purchased for government departments. The volume of government purchases, however, is small as compared to the volume of purchases made by states, municipalities, public institutions and private corporations. With the idea of encouraging the use of specifications for such purchases, Secretary Hoover took steps about a year ago to have collected into one handbook or dictionary, all of the well recognized standard specifications in general use. This publication will include not only the specifications adopted by the Federal Specifications Board, but all others found to be satisfactory for their respective purposes.

The project was launched last May at a conference in Washington of the official representatives of the state governors called together by Secretary Hoover. At that meeting the National Conference of State Purchasing Agents agreed to co-operate in the preparation of the handbook of specifications by making a canvass of the state purchases in order to determine what are the most important items from the point of view of the states as consumers.

An advisory Board was organized as a result of a second meeting held in June. On the Advisory Board are representatives of most of the state and national organizations interested in the preparation and unification of purchase specifications. The Advisory Board will function on such matters as the classification of commodity specifications, the form and size of the publication, and the scope of the proposed handbook.

Dr. A. S. McAllister, engineer physicist, of the Bureau of Standards, has been put in charge of the actual work of collecting the material and getting out the handbook. The work of gathering existing specifications is well along, more than 90 per cent of all federal, state and municipal specifications having been gathered. In addition, 500 public purchasing agencies have been communicated with and there has been compiled a list of nearly 500 trade associations and technical societies that are interested in specifications. These organizations have been communicated with and almost all of the material that they can supply has been obtained.

To give you some idea of the material on hand, it is estimated that nearly 9,000 specifications covering some

The Bureau of Standards from the air

5,000 commodities and containing upward of 12,000,000 words are now in use. The specifications mentioned cover only about 5,000 commodities, although it is estimated that some 20,000 commodities are regularly purchased, and could be covered by specifications.

LIST OF SPECIFICATIONS BEING COMPILED

There is now in preparation a list of all the known existing specifications which will be issued in convenient form, properly classified, to be widely distributed for the purpose of obtaining corrections and additions. This list, although initially somewhat incomplete, will prove of great service to all agencies interested in specifications. When it has finally been revised and corrected, it will serve as the basis for the handbook or encyclopedia.

The magnitude of the task ahead of the compiler of the handbook can perhaps be realized when I say that the material on hand if put in printed form would fill about forty-eight volumes of the size of those issued by the American Society for Testing Materials, or twelve volumes of the Encyclopedia Britannica. Dr. McAllister has made a rough preliminary guess that this volume can be boiled down to about ten volumes of the A.S.T.M. Standards, or three volumes of the Encyclopedia Britannica.

The index mentioned is about two-thirds completed. One section, that relating to foods and kindred products, has been completely indexed. It contains less than 10 per cent of the estimated number of cards in the index as a whole, notwithstanding the fact that nearly 50 per cent of the money actually expended for commodities by the federal and state governments and public institutions is used in the purchase of food for human consumption and of feed and forage for animals.

A survey of the existing specifications shows that in certain branches of industry the work of specification making is well advanced while in other branches practically no work at all has been done. How best to select the most satisfactory specifications and bring them most promptly to the attention of the public purchasing agents is a problem the solution of which is now being given consideration by the Advisory Board.

Dr. McAllister and Mr. Harriman both have offices in the Administration Building of the Bureau of Standards, on the same floor as the office of the director of the Bureau. The work they are doing is of decided interest to almost all American manufacturers and engineers, and a few minutes spent in getting acquainted with it will be well worth your while the next time you come to Washington. You as a taxpayer are helping to foot the bills for these activities, and your state or municipality as a purchaser and consumer will profit from the results they obtain. The Bureau is open from 9 until 4:30 daily, and your visit will always be welcome.

Increased Demand for Machinery in Asia

The volume of machinery imported into China during the pre-war period (1910-1913) was greatest in 1910, when it attained a value of about $7,220,000, but this total has been exceeded every year since 1918, and for both 1921 and 1922 was more than $41,000,000, according to *Commerce Reports*. During those years China absorbed machinery anywhere from 5 to 12 times the rate in pre-war years, depending upon the years selected for the purposes of comparison. This is characteristic of most of the countries of Asia which are now absorbing machinery, as used in factories, mines, and construction work, at a rate that could scarcely have been credited in pre-war days. Recently 25 per cent of the machinery exported from the United States has gone to Asia.

"Lonealing"—A New Term in Heat Treating

A NEW term, "lonealing," appears in the following definitions of terms relating to heat treatment operation, which were tentatively approved by the Recommended Practice Committee of the American Society for Steel Treating, January 31, 1924.

The report was prepared by a sub-committee consisting of R. M. Bird, Chairman, with the following members: Bradley Stoughton, Professor of Metallurgy, Lehigh University, Bethlehem, Pa.; H. J. French, physicist at the Bureau of Standards, Washington, D. C.; Sam Tour, metallurgist at the Doehler Die Casting Co., Brooklyn, N. Y.; B. F. Shepherd, assistant metallurgist at the Ingersoll Rand Co., Phillipsburg, N. J.

From the sub-committee the report was given to the Recommended Practice Committee of the society where it was approved for submission to other technical societies and interested individuals, as well as to the membership of the society, for criticism and comment, before being made a tentative recommended practice by the society.

Any reader of the *American Machinist*, wishing to comment upon the tentative definitions, may do so and should address J. Edward Donnellan, Secretary of the Recommended Practice Committee, 4600 Prospect Avenue, Cleveland, Ohio. It is hoped that the readers will express their opinion freely whether in favor of the definitions or not.

Foreword

During recent years, heat treatments have become more and more complicated and as a result there has arisen certain confusion in regard to the meaning of commonly used terms. For instance, in one locality or trade, any operation of heating and cooling resulting in a softening of the material is being called annealing, whereas in other places to "anneal" means not primarily "to soften" but to heat to above the "critical temperature" and to cool very slowly. Similar confusion as to the meaning and application exists in regard to other terms and as a result "annealing," "tempering," "normalizing," etc., are being used by different people to mean widely different things.

In any attempt to accurately define the terms commonly used in connection with heat treatment, the first question to decide and the most important one is, do the terms relate to the heat treatment operation itself or to the results obtained by the treatment? In other words, is the term indicative of the structure or the condition obtained or of the operation performed?

After careful consideration, it appears most logical and most in keeping with present-day usage to have the terms so defined that they shall mean definite operations and shall not be considered as referring to the structures of general conditions resulting, although, in a great majority of cases, the structures or conditions resulting may be quite similar.

At first glance, it would appear entirely unnecessary to coin any new words. It seems, however, that one of the reasons for the confusion that has come to exist is the lack of adequate terms with which to express the different operations and conditions met with. In suggesting the use of the term "loneal," an attempt is made to relieve the term "anneal," of some of the misuse which it suffers and to eliminate the term "draw" which has such wide application in regard to the mechanical operations performed on metals as distinct from thermal treatments.

In commercial practice, the terms here defined will vary slightly depending upon the material under consideration. A "relatively slow rate of cooling" does not mean the same thing for an alloy steel as for a plain carbon steel, but the general meaning of the terms should remain the same regardless of material being treated. This must necessarily be the case if the term relates to the actual operation and not to the structure or the condition resulting from the operation.

Heatings and coolings, during any part of which steel is worked mechanically, are excluded from the meanings of the terms here given.

By "heating" as appearing below, is meant a thorough and uniform penetration of the heat.

By "critical temperature" as appearing below is meant that temperature which is customarily associated with the following phenomena:

(a) Hardening when quenched
(b) Loss of magnetism
(c) Absorption of heat
(d) Formation of solid solution
(e) Pronounced refinement of coarse grain upon cooling.

Heat Treatment Definitions

Annealing. Heating above the "critical temperature," followed by a relatively slow rate of cooling.

Lonealing. Heating below the "critical temperature," followed by any rate of cooling.

Normalizing. Heating above the "critical temperature," followed by an intermediate rate of cooling. (Note—In good practice, the heating is considerably above the "critical temperature.")

Spheroidizing. A long-time heating at or about the "critical temperature," followed by slow cooling throughout the upper part of the cooling range. (Note—For the purpose of spheroidizing the cementite in high carbon steels.)

Hardening. Heating above the "critical temperature," followed by a relatively rapid rate of cooling.

Tempering. Reheating, after hardening, to some temperature below the "critical temperature," followed by any rate of cooling.

Carburizing. Adding carbon, with or without other hardening elements, such as nitrogen, to wrought iron or steel by heating the metal below its melting point in contact with carbonaceous material.

Case Hardening. Carburizing the surface portion of an object and subsequently hardening by suitable heat treatment.

Cyaniding. A specific application of carburizing where the object, or a portion of it, is heated and brought into contact with cyanide salt.

The Design of Cone Pulley Drives—Erratum

A typographical error appears in the sixth line from the bottom of page 246, Vol. 60, in Mr. Odegaard's article on "The Design of Cone Pulley Drives." The symbol B_2 in this line should be B_1.

A British Method of Building Axles

By A. J. Aiers

The fixtures employed in machining a malleable-iron axle housing for an 11-hp. car—Double-duty fixtures minimize chances for making errors

THIS article describes the jigs used and methods employed in the production of axle housings for an 11-hp. automobile, of a construction differing materially from that used in the United States. Details of the housing are shown in Fig. 1. The housing is in halves, the material being malleable cast-iron. The halves had to be machined with a spigot at the large end, and it was therefore necessary to make the jigs and fixtures adaptable to both parts.

Trouble was experienced by the large end caving in during annealing, and to overcome this difficulty, struts were cast across the end as shown dotted at *A* in Fig. 1. Fig. 2 is a photograph of the housing after it was finish machined. In this view, part of the brake work is shown assembled.

The first operation is to cut the strut away from the large end, on a horizontal milling machine having two saws mounted on the arbor. The saws cut the strut at both ends. The casting is then countersunk at each end ready for the turning operations. The sleeve is mounted on a mandrel by means of cones which fit into the chambers, and the mandrel mounted between centers in the lathe. The mandrels are left assembled in the housings during the turning of both ends, so that they will be perfectly true, and for all future operations the sleeve is positioned from the turned ends.

One of the machines used for these operations is shown in Fig. 3. This machine turns the large end, and the housing is then passed to the next machine for turning and threading the small end.

The next operation consists of drilling and reaming the four holes in which the brake cams and adjusting toggles are fitted. The jig used for this operation is shown in Fig. 4. It consists of a main casting, compris-

Fig. 1—Details of the two-part axle housing

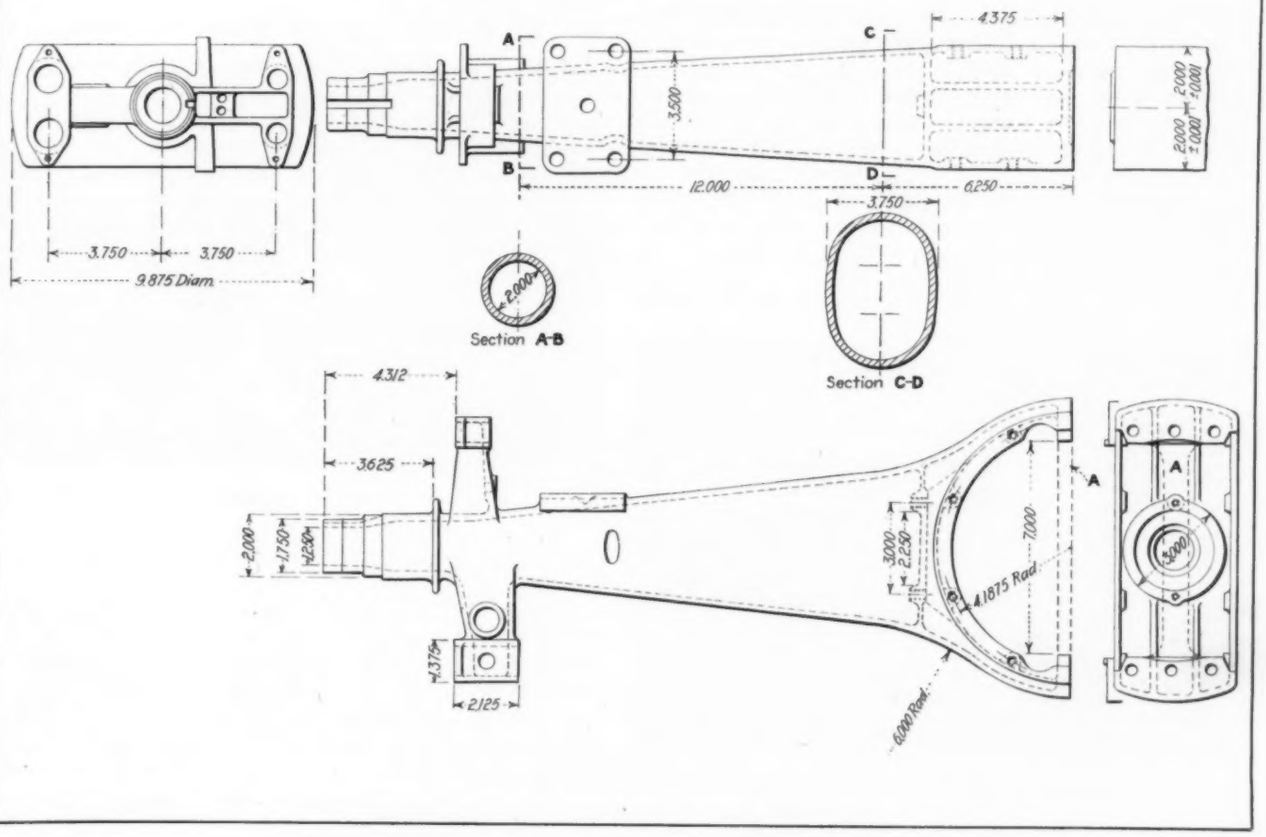


Fig. 2—A completed housing

ing a base plate with two supporting pillars converging at the top to form a drill plate and also a support. The housing is positioned at the large end by either fitting into the hole *A*, or onto the plug *B*, according to which half is being machined. At the small end, the collar *C*

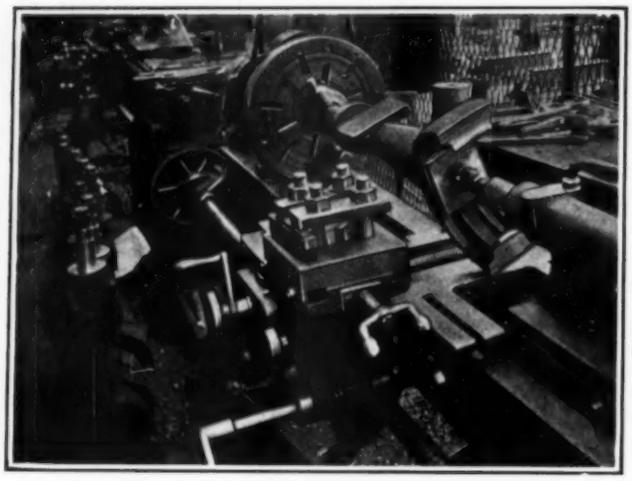


Fig. 3—Turning half-housing in lathe

fits over the machined part, being forced up tight by the action of a wedge cutting the collar and the pins *D*, fixed in the casting. Two V-blocks *E*, positioning on the bosses which are to be drilled, are used to obtain the radial location. Slip bushings are provided so that the sleeve can be drilled and reamed without removal from the jig. The sleeve is not symmetrical as is shown by the dotted lines. The bosses are longer on one side than the other and are also drilled with holes of a different size. In order to insure the operator putting the sleeve in correctly, a pin is fixed in the jig casting on the side where the short bosses are located, and the $\frac{5}{8}$-in. and $\frac{1}{4}$-in. bushings are different

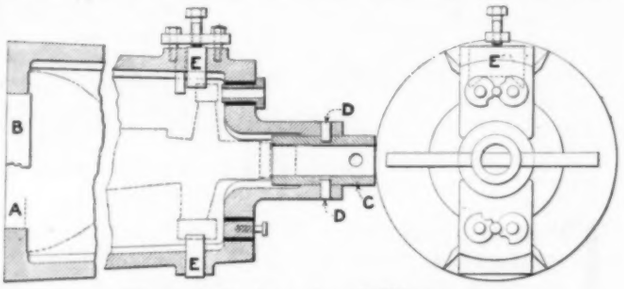


Fig. 4—Fixture for drilling arms

sizes outside, so that mistakes are next to impossible.

The jig used for operations 6 and 7, is shown in Fig. 5. These operations consist in drilling the holes through which the bolts clamp the two halves together, as well as the oil retaining-plate holes. The small end of the housing is located in a recess in the base plate *A*, and rests on the face of the bosses which were turned in the 4th operation. The drill plate *B*, is located by means of pins from the casting faces and fits on to the spigot. The drawing shows the modifications necessary at *C* and *D*, so that both halves can be accommodated in the same jig. The same jig is also used in drilling the oil baffle-plate holes at *E*.

The jig plates for both this and the previous operation are drilled large enough so as to pass over the nuts, and open washers are provided to facilitate production.

Milling and Drilling Spring Platform

The jig for milling and drilling the spring platform or pad, is shown in Fig. 6. The method of location is the same as before, by a spigot at the large end and a collar at the small end. As will be seen, the plate is made to suit both halves of the axle housing. It is necessary that the pad should be at a certain angle in relation to the sleeve, therefore, it is positioned by plugs in the bolt holes at the large end, which throw the hous-

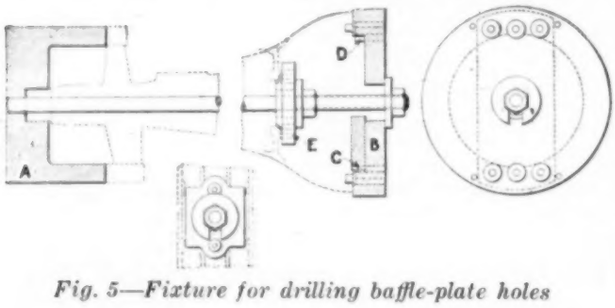


Fig. 5—Fixture for drilling baffle-plate holes

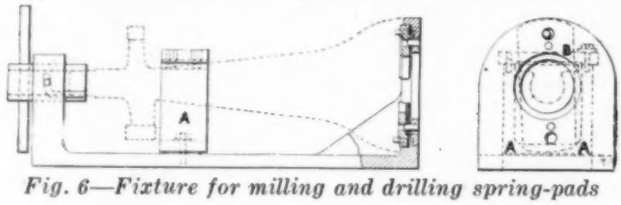


Fig. 6—Fixture for milling and drilling spring-pads

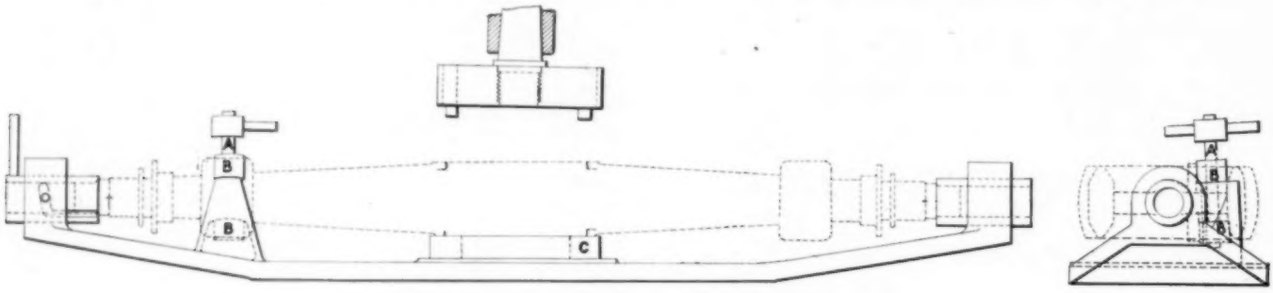


Fig. 7—Fixture for facing and boring flange

ing over the necessary amount. The U-shaped piece *A*, projects up on each side of the pad and gives the height for setting the milling cutter. When drilling the pad, the drill plate *B* is located on top of the U-piece.

The two housings are now bolted together to form the one-piece sleeve, ready for the boring and facing of the center portion.

In operation the opening in the center is faced at the proper angle with the spring pads. The fixture is shown in Fig. 7. This operation is performed on a vertical milling machine, and as it is important that the face of the drive case should be at a certain angle with the spring pads, the pads already machined are used for location.

The housing is held at each end by collars, one of which is fixed, the other having a cam groove cut in it for tightening. Shafts, as at *A*, on which eccentric rollers *B* are mounted, are used on each of the spring pads to locate the sleeve at the correct angle. Three jacks are then mounted under the center portion so as to provide a solid foundation during the cutting. These, or other compensating devices are necessary, as they bear against the rough surface of the casting at the points of support.

When boring and facing the opposite face, the packing piece *C* is used, and, as the face on which it bears has been machined is then a true face, it is not necessary to use the rollers on the spring pads. The next operation consists of drilling and tapping the drive-case flange, the jig being shown in Fig. 8. The housing rests on a V at each end, the drill-housing plate *A* being located in the bore of the housing and by pins in the jig casting. The plate is drilled with a large hole to pass over the nut, and slip washers are used for rapid handling.

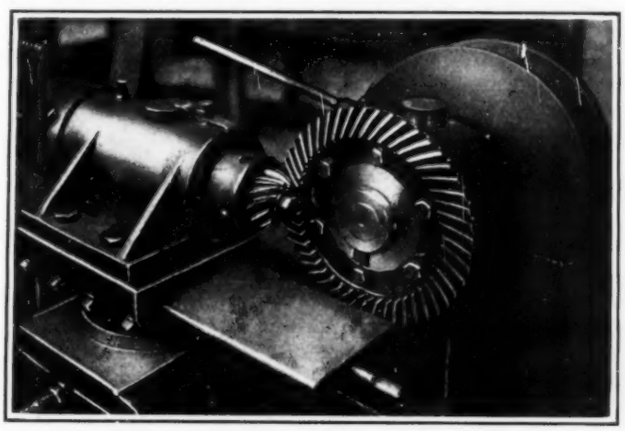


Fig. 9—Lapping the gear teeth

The housing is now ready for assembling; the hubs, with brakes complete on the ends, and the driven or differential case in the center. Although every care is taken during the hardening of the spiral bevel-gears, they are not perfect, so a running-in fixture was designed, the general design and construction being shown in Fig. 9. Both the pinion shaft and the spindle carrying the larger gear are mounted on both radial and thrust ball-bearings. Felt washers are used at all points where necessary, to exclude dust and abrasive from the bearings.

The adjustments necessary to put the gears in alignment, are secured by the compound slide on which the pinion housing is mounted. The bevel-gear carrier is therefore fixed directly to the bed of the machine. After adjusting until the wheel and pinion are in correct mesh, emery and oil are applied to the teeth and

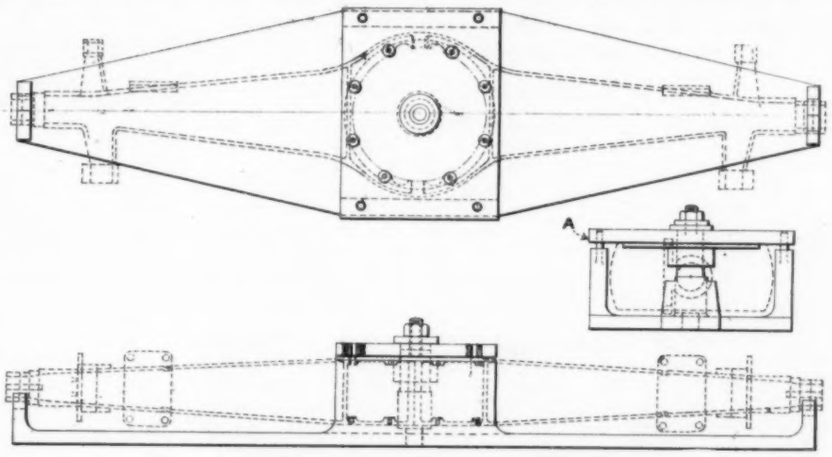


Fig. 8—Fixture for drilling drive-case flange

the gears run until the necessary quietness is obtained.

The running-in machine is driven by a pulley on the pinion shaft. The crown-gear spindle carries a drum to which a brake band operated by a toggle is fitted, the operating lever for which can be seen at the back of Fig. 9. Weights are attached to the brake lever in varying positions to correspond to certain loads. Provisions is made for internal water cooling of the brake drum.

Before the drive or differential case is assembled into the axle housing, the unit is tested in the fixture shown in Fig. 10. The complete unit with gears mounted in position is bolted to the angle plate *A*. Brackets *B* on each side, support the spindles which carry the brake drums *C*. The two brackets also carry the expanding brake shoes which are operated by the levers shown at *D*, through links to the toggles. The two thumb nuts projecting at the top are for adjusting the shoes as they wear. If the drive case passes this inspection, it is passed to the assemblers ready for erection into a complete rear axle unit.

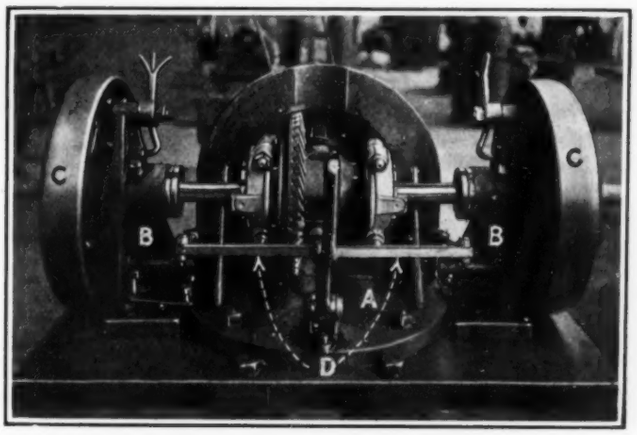


Fig. 10—Testing completed axle

Rules for the Safe Handling of Gas Cylinders

THE Gas Products Association, 140 South Dearborn St., Chicago, a trade organization composed of the producers of oxygen, hydrogen and acetylene compressed gases and welding and cutting apparatus manufacturers, has prepared the following rules for the safe handling of cylinders containing compressed oxygen, hydrogen and acetylene.

Oxygen

1. Compressed oygen plus oil is explosive. Allow no oil or grease of any kind to come in contact with valve, regulator or any other portion of the cylinder or apparatus.

2. When shipping empty oxygen cylinders to manufacturer, lower portion of green tag attached to cylinders should be removed at the perforated line. Any green sticker label found pasted to the cylinder should be removed. Bill of lading should specify that cylinders are empty and serial numbers of the cylinders should be noted thereon.

3. Cylinders of oxygen, except those in actual use and in excess of approximately one day's supply required in any one department or point about the shop, should be stored in a place where they will not be tampered with by unauthorized persons.

4. Oyxgen cylinders should be stored in a safe, dry place, where they will not be exposed to the heat of stoves, radiators, furnaces, or in the direct rays of the sun. Heat will increase the pressure and it may cause the safety plug or disk to melt or blow, thus allowing oxygen to escape, resulting in waste. If the escaping oxygen comes in contact with even the smallest flame it has such a tremendous influence upon combustion that a quick raging fire is liable to result.

5. Cylinders of oxygen are never to be stored in the same room used for the storage of calcium carbide, cylinders of dissolved acetylene or other fuel gases, or with acetylene generators.

6. Open flames of any description sha'l not be employed in any building used for the storage of oxygen cylinders.

7. If cylinders are stored on the ground or open platforms, such locations should not be adjacent to points where there is a large amount of combustible material.

Note:—While oxygen itself will not burn, its effect in aiding combustion, once a blaze is started, makes it important that rules 4 to 7 inclusive be carefully observed.

Acetylene, Hydrogen, Etc.

1. When cylinders of dissolved acetylene, hydrogen, liquid fuel gases or vapors are not in use, outlet valves shall be kept tightly closed, even though cylinders may be considered empty, and valve caps replaced.

2. Cylinders should be stored in a safe, dry, well-ventilated place where they will not be unduly exposed to the heat of stoves, radiators, furnaces, or the direct rays of the sun. Heat will increase the pressure, or it may melt the fusible safety plug with which most cylinders are provided and which melts at a temperature of approximately 212 degrees to 220 degrees F.

3. No open flame, grinding tools, or spark-emitting devices shall ever be used within the storage building or compartment, and all artificial lights shall be incandescent electric and shall be installed in accordance with the "National Electrical Code for Rooms in Which Inflammable Vapors May Exist."

Electric light switches, telephone and all other apparatus which may cause a spark must be located on the outside of building.

All lamps shall be enclosed in vapor-proof globes of the Marine type.

4. Cylinders of dissolved acetylene shall always be stored standing upright with valve end up.

5. When shipping empty dissolved acetylene cylinders and other fuel gas cylinders to manufacturers, lower portion of red shipping tag attached to cylinders should be removed at the perforated line. Any red sticker label found pasted to cylinder wall should also be removed. Bill of lading should specify that the cylinders are empty, enumerating the type and the individual numbers of such cylinders.

6. Under no circumstances attempt to transfer acetylene from one cylinder to another and never under any conditions attempt to compress acetylene into a cylinder. This work should only be performed by acetylene charging plants, and under conditions which comply with Interstate Commerce Commission regulations.

General

1. Oxygen cylinders and acetylene, hydrogen or other fuel gas cylinders shall not be transported or lifted by crane or derrick except when they are in a cradle or substantial stand, and cylinders shall never be handled with electro-magnets or with rope or chain slings.

2. Cylinders should be handled carefully, should never be dropped, and should be placed so they will not fall nor be struck by other objects. Knocks, falls, or rough handling are liable to damage the cylinder, valve or fuse plugs, and cause leakage, and may even result in an explosion.

3. When exhausted, cylinders shall be returned as rapidly as practicable to the storage building or place, and from there to the manufacturer. Empty cylinders should be marked "EMPTY" and stored apart from full cylinders to prevent confusion. Valve protection caps must be replaced.

Treat the Drill Press to a New Table

By Donald A. Hampson

Probably no other machine tool gets as hard usage and as little care as the upright drill. In the larger shops, the newest and rawest help is put to work on the drill; in the smaller shops the drills are in the "free for all" rank and everyone from the newest apprentice to the boss uses them for occasional jobs.

A glance at the average drill-press table will show that it is the most abused of all machine parts. It shows plainly that it has been used "to learn on," as some one has phrased it, but the learning did not go very far. It is next to impossible to do a good job on one of these drilled-up tables, yet men are expected to do good jobs on them, and little thought is given to the ease with which they may be renewed.

Actually, it is a simple and inexpensive matter to put a drill-press in first-class condition. A new table, a new spindle and a new spindle sleeve are the only parts likely to be needed, and these are cheap as compared with corresponding vital parts of, say, a milling machine.

But it is the table that gets the worst treatment, and the table is the easiest of all the parts for the shop to renew.

By using the old table a very fair pattern can be arranged in short order. A covering of ¼ in. boards should be laid over the surface—thicker if desired—to provide for finishing in the lathe and for a slight increase in thickness. The outside diameter is relatively unimportant and no adding on need be done here. The table slots can be cast from the old ones, each slot forming a green sand core of its own, but the better way is to make a corebox for them and stick a print in each slot in the old casting; by so doing cleaner slots will be secured and they can be cut clear through the additional metal on the face of the table. Extra metal for turning the shank is provided by winding the same with pasteboard or building paper to the desired amount.

When the new casting is received, it can be machined to measurement without interruption of drill-press service. Any lathe that will face square will do a job that is equal to factory parts.

The comparatively small amount of time spent on this re-conditioning job will be repaid many times over.

Arc Welding Sheet-Metal Parts

By Albert R. Luechinger

What constitutes good welding—Proper methods of welding different kinds of seams—How welding operators should be trained—The use of fixtures in production welding

WELDING, today, is fast becoming one of the most efficient and economical methods of joining together parts that were usually riveted, regardless of what method of welding is used.

One of the unfortunate peculiarities of welding, be it gas, arc, spot or thermit welding, is that it is often judged by one's first contact with it. Therefore, if one has seen a weld made by a good welder one appreciates its possibilities, but if the weld is made by a poor welder it is automatically judged as an unreliable process.

It has been the writer's experience in the repair field, as well as in the production field, that where a weld failed, it took an unusually long time and extra effort to convince people that welding was reliable.

One cannot hope for successful welds if a poor welder is employed to make the weld. A process that depends so much on manual ability and dexterity in manipulating the arc for successful welds, naturally brings about the essential fact that great care should be exercised in selecting and training the men who are to do the welding. The writer has often heard that it only takes a few weeks to make an arc welder. However, as simple as welding may look to the uninitiated, it will be found that a longer training will mean better results in the end.

A man may acquire the ability of manipulating the arc in a comparatively short time, but his welds cannot be depended upon, due to his lack of practical experience which is required to make a good weld. A good welder should have a well developed sense of responsibility. He must be able to produce work of the highest class without being watched, for no one but the welder himself really knows what kind of a weld he has produced. Therefore, if a man has no sense of responsibility, he may produce a defective weld on an important job.

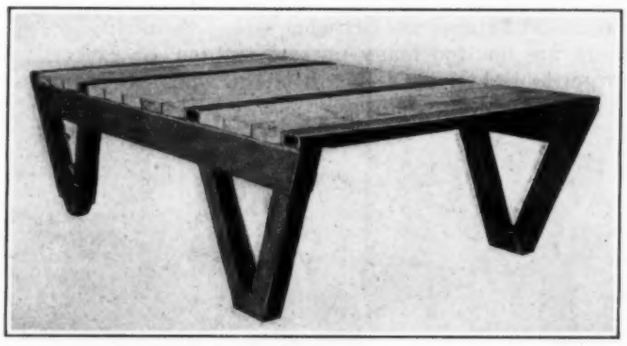


Fig. 1—All-welded 8-ft. platform body for use with an electric truck

Next in importance comes the proper supervision of the welders. A man who, by experience, is able to help them with their problems and also is able to keep their work at a high standard of efficiency is required. A good foreman will encourage his men to tell him of the various defects encountered in welding the different parts and together they may bring about the solution of their troubles, for very often a welder's complaint is overlooked, and yet that complaint may be the reason the job is not turning out as expected.

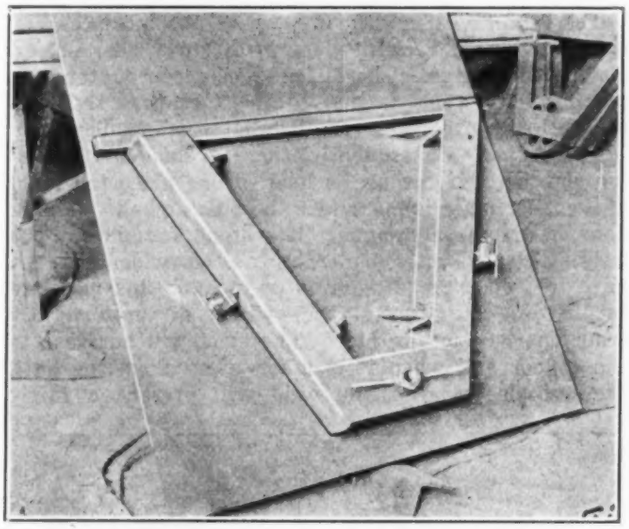


Fig. 2—Welding fixture used to assemble the wheel and plain legs of platform bodies

The wire used for filler rod in welding should be of the proper analysis for the work to be done. Bulletin No. 2 of the American Welding Society covers this field to a certain extent and will prove an aid in determining the proper electrodes to use. The various advantages and disadvantages of the different types of electrodes, i.e., bare, coated and covered, will not be discussed in this article. Each type of electrode has its good and bad points and should be chosen after making a careful survey of the various types and determining if they are readily adapted to the type of work that is under consideration.

A great deal of the success in welding depends on the design of the parts to be welded. The design of a part to be welded should be given careful consideration, as work of some types can be welded more readily than others.

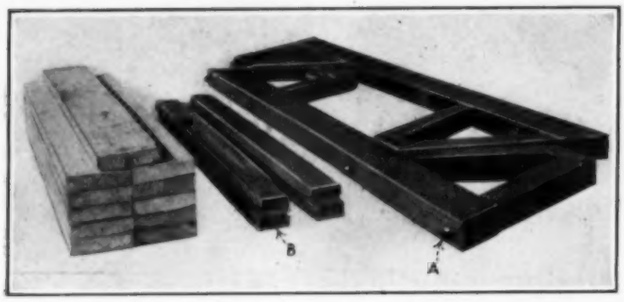


Fig. 3—Parts used in 8-ft. wood-top body, ready to be assembled into a complete unit

A lapped seam is the better type of construction in preference to the butt seam, as inaccuracies in shearing will not be noticed as much in a lap as in a butt seam. If the plates are sheared a trifle too short in work that is to be butted, a larger opening will be left to fill with welding rod, with the result that more time will be required to do the job.

The time saved in shearing, where absolute accuracy is not required, as in plates for lap welds, should also be considered. The difficulty often encountered in making butt welds is due to the fact that the heat absorption at the edge of the plates is smaller than in the center. Consequently, there is danger of burning the metal if the arc is held in one place too long. If a copper plate is put under the butt and the welding done in the usual manner, it will be found that the welding time is cut considerably, as the welder does not have to stop every few minutes to allow his metal to set in order to prevent the making of an unsightly seam on the opposite side. The steel will not fuse to the copper and when it is taken away from the butt, the opposite side of the weld will present a fairly

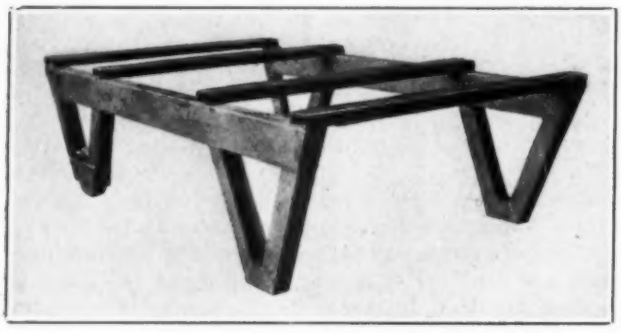


Fig. 4—Cross members bolted to side members, ready to be welded

smooth appearance. However, lap welds do not present the above-mentioned defects, and in the writer's opinion are the ideal welds to make.

A designer should always remember that what looks good on paper may prove a very poor job from a welding point of view. Unforeseen difficulties in welding often show up in the first design. There may be a corner which creates a draft when the heat of the arc starts to make a furnace of the corner, with the result that welding can be done only under the greatest of difficulties.

This last phenomena has been observed by the writer at different times. The true cause is not known. It may be a magnetic field that has some influence on the arc, or a miniature furnace with the drafts created by the intense heat of the arc, causing the arc to act in a very erratic manner.

Some examples of production welding are given herewith.

There is shown in Fig. 1, one of the platform bodies for industrial trucks. While these bodies are rated to carry 2½ tons, an overload is a very common occurrence, consequently they must be able to stand, not only a great overload but a great deal of abuse as well.

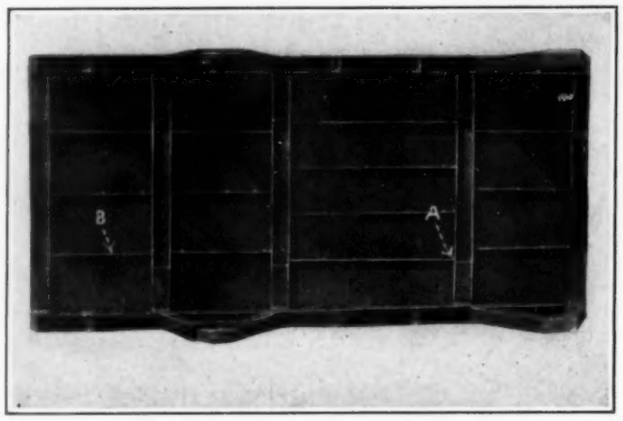


Fig. 5—Under side of a metal-top body

Wherever possible, fixtures are used to assemble the members and hold the parts in position while being either welded or tack welded. Fig. 2 shows a fixture for assembling both the wheel legs and the plain legs. After the parts are tack welded, the legs are removed from the fixture and welding is completed on the bench. The plain legs are also tack welded on this fixture. As the seam to be welded is a butt seam, a copper block is placed under it.

The sides are shown assembled in Fig. 3. Bolts, as at *A*, are used to correctly space the two sides and are tack welded in the frame. The cross members *B* are welded in the following manner. A gage block is put between the two pieces to give the correct height, and a bar having two studs in it is put into the holes to space them correctly. They are then welded and we have found that the possibility of error by using this method is negligible. The very simplicity of the gages and fixtures used is what makes them efficient, as there are not too many nuts to tighten, or rather, to forget to tighten, and thus hold the work insecurely.

Fig. 6—A platform body in use

The parts are then bolted together with the bolts shown at *A* and then welded. This method makes a strong and rigid job and has given good results.

The frame for the platform body is shown bolted together in Fig. 4. The cross members are welded to the side members, completing the frame assembly. Either a wood or metal top can be used to complete the bodies, depending on the kind of work for which they are to be used.

The underside of a metal-top platform body with stiffeners in place is shown in Fig. 5. These stiffeners are welded to the cross members at *A* and tacked to the floor plate as at *B*. This type of construction serves to stiffen the floor plates against unusually heavy loads.

A platform body is shown in use in Fig. 6. Welded platforms will withstand a great deal of abuse without becoming shaky, as would a riveted job and consequently their lives are considerably longer.

When manufacturers of products that can be adapted to welded construction, realize that a good welder, given a well designed job to weld, will turn out a higher grade of work than it is possible to attain by riveting, the progress of welding will be very rapid, and more and better trained welders will be available.

Job Costs for Machine Shops

By John C. McNeil

AN ELABORATE cost system is an unnecessary adjunct to a machine shop when a complete record of the cost of each job going through the shop is wanted, and the high cost of cost accounting can be eliminated through the use of two simple forms described below.

It is assumed that the machine shop uses up-to-date methods in the office as well as in the shop, and that its ledgers and necessary general records are handled by machines. Each job is assigned a job number after entry in the books, and the engineering or estimating department should give the cost department an estimate of the cost of each particular job, divided among the general charges of labor, material and overhead. All direct labor chargeable to the job should go into the labor column, and the indirect labor will, under this system, be charged into the overhead column.

We are not going to split hairs over direct, indirect, and other high sounding cost-accounting phraseology, but we are going directly to the costs of the job, which is the thing of interest to the manager. The job costs will be posted daily and the work will never be more than one day behind.

The two forms are the Job Cost Ledger, Fig. 1, using

JOB NO. 1238

JOB COST LEDGER

PRICE CHARGED OR QUOTED $8,500.00

	DESCRIPTION OF JOB	ITEMS	ESTIMATED COSTS	ACTUAL COSTS	EXCESS OF ESTIMATE
DATE July 1, 1923. ENGINEERING FILE 2867 DATE COMPLETED	BRAKE BEAMS- Southern Railway. Order File 8506 500.	LABOR MATERIAL OVERHEAD TOTAL	1,600.00 5,600.00 400.00 8,600.00		

OLD BALANCE	DATE	POST	DESCRIPTION	LABOR	MATERIAL	OVERHEAD	TOTAL COSTS TO DATE	JOB NO.
0 00	1923 July 1	C-1865	Labor.	18.64				
		VC-186	Iron.		250.00			
		JV-284	Engineering.			50.00		
318 64	2	C-1920	Labor.	19.20			318.64	1238
		R-1850	Forms.		20.00			
357 84	3	JV-286	Supervision.			35.78	357.84	1238
393 62	6	C-2004	Labor.	24.62			393.622	1238
		VC-200	Iron.		38.76			
		R-1900	Forms.		25.00			
		JV-290	Supervision.			30.00	512.00	1238

Fig. 1—Job cost ledger

JOB COST JOURNAL FOR July 6th 1923

OLD BALANCE	DATE	POST MEDIA	DESCRIPTION	LABOR	MATERIAL	OVERHEAD	TOTAL COST TO DATE	JOB NO.	ESTIMATED COSTS	SELLING PRICE	
393 62	6	C-2004	Labor.	24.62							
		VC-200	Iron.		38.76						
		R-1900	Forms.		25.00						
		JV-290	Supervision.			30.00	512.00	1238	5,600.00	6,500.00	
150.00	6	C-2005	Labor.	19.20							
		VC-201	Steel.		24.20						
		R-1901	Forms.		10.00						
		JV-290	Engineering.			5.00	189.20	1152	650.00	700.00	
200.00	6	C-2006	Labor.	12.00							
		VC-202	Iron.		5.00						
		JV-206	Engineering.			2.00	219.00	1340	225.00	250.00	
743.62			Proof Totals.	55.82	102.96	37.00	939.40				

Fig. 2—Job cost journal

a ledger card for each job, and the Job Cost Journal, Fig. 2, using one or more sheets for each day's work. With these two records, the shop will be able to tell daily the total costs applicable to each particular job in the shop, as well as the total cost to date. This total cost to date can be compared with the estimated costs, and the management can see at once if it is keeping within the estimate. The price quoted or charged will also appear on the cost ledger card and a comparison of the total costs to date with this figure will show whether or not the job is being run at a loss.

Posting Labor, Material and Overhead

The employees working on this particular job are given the number of the job in order to charge it through their time cards. After the time or clock cards come into the office all labor items are posted directly to the job upon which the employee worked. Material items are posted directly from invoices or requisitions covering the material used. Overhead is posted directly from the overhead distribution sheet, which sheet will be pro-rated over the jobs worked upon on the basis decided upon by the management.

It is unnecessary in this discussion to describe the method of apportioning overhead, as this depends entirely upon each individual case. A machine hour method might suffice for one machine shop, while another might find the space occupied the more efficacious. The ledger card and the journal are posted at one operation, the journal remaining in the machine until filled or until all entries for the day in question shall have been posted. The journal is first put in the machine and the ledger is placed upon it, with carbon paper between them. The old balance is written in the left hand column, then the date, identifying posting medium and description. Labor items are posted in the labor column, material items under material and overhead items under overhead. The machine adds all of these items to the old balance and automatically gives the new balance which is the total cost on that particular job down to and including the last posting.

The job number is then written on the ledger sheet, and appears on the journal also. From the data shown on the ledger card, items are also posted on the journal showing the estimated costs and the selling price, for comparative purposes.

Totals Shown by Cost Journal

After the day's posting is done, the cost journal will show the total of all labor charges, the total of all material charges and the total of overhead. As a proof of accuracy, the total labor charges may be checked with the payroll totals chargeable to job costs, the material may be checked with the purchase or voucher journal of material charges to jobs, and the overhead may be checked with the overhead distribution.

The estimated costs and selling prices are merely inserted for managerial information and, by looking over the journal sheet or a copy if wanted, the manager can tell at a glance which jobs are keeping within estimates.

One girl operator can handle the cost ledger postings and journals for shops having three to four hundred different jobs running, and there would be no use for a lot of high priced clerks making history by compiling costs for two or three weeks previous to the entry. The complete record of costs on each job is given without resorting to elaborate detail.

What Is Your Advice Worth?—Discussion

By J. Madden

I was glad to see the article under the title given above by L. N. Miller on page 356, Vol. 60, of the *American Machinist*. I think that Mr. Miller is right in the conclusion that he has evidently made in his own mind to the effect that the machine tool builder should be paid for the engineering advice which he furnishes.

It is one thing to feel that the advice should be paid for but quite another to collect. In the article a parallel was drawn between the machine tool builder and the lawyer and doctor. Right there is where Mr. Miller overlooked a point, and it seems to me that his firm should not have asked Mr. Hendricks for payment. Custom has made it understood by everyone that, when a man goes into a doctor's office or a lawyer's office for the purpose of consultation, he must buy the advice. Just as surely custom has made it unnecessary to pay for engineering service such as that referred to.

The day may come when the man in need of engineering service will go into the machine tool builder's office with the expectation of paying for what he receives, but until that custom has been firmly established, it will be necessary for the machine tool builder to let his client know in unmistakable terms before he gives the service that there will be a charge. Under present conditions he cannot try to collect after the service has been given.

Do You Advertise in England?

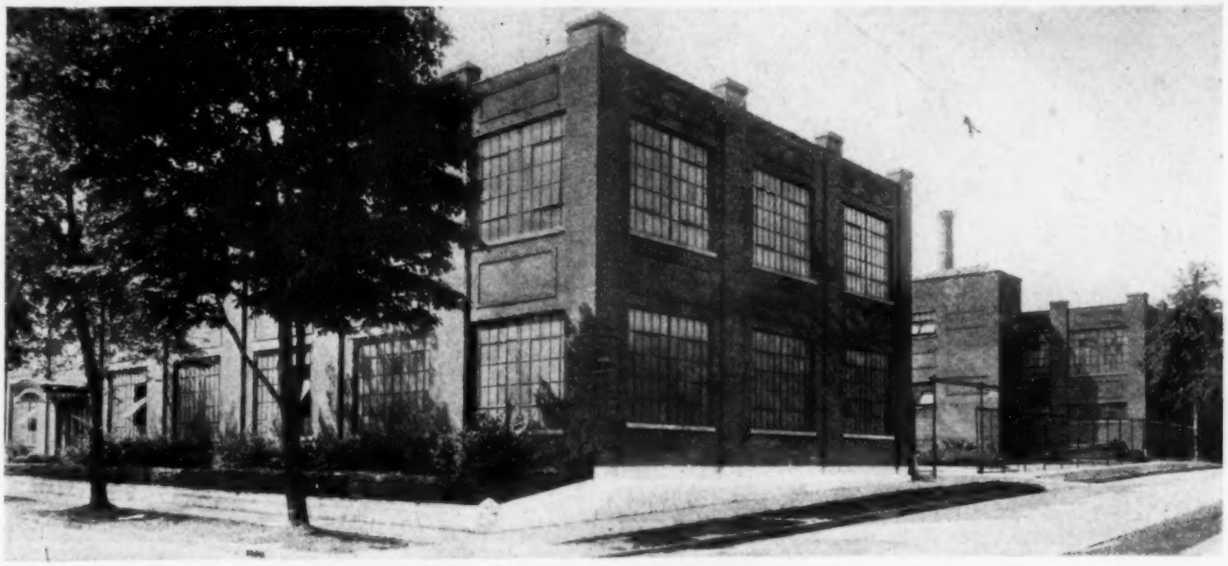
Don't ask for a drug-store if you fall sick in England or you may be suspected of being a "drug-fiend," says Trade Commissioner H. B. Allin-Smith in a report to the Commerce Department on British business English. A drug-store in England is a "chemist's shop." A "store" isn't a store, it is a "warehouse." "Dry-goods" are not sold in "drygoods stores"; they are sold in "draper's shops," and they aren't called dry-goods either. They are "drapery" or "mercery." Candy isn't candy, it is "sweets" or "lollies"; peanuts are "monkey nuts." A monkey wrench is a "spanner."

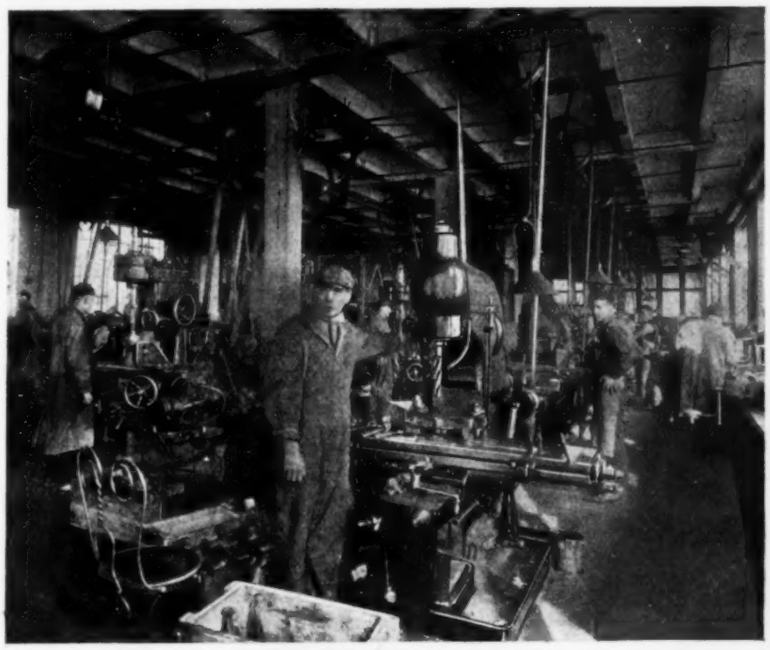
Many an American advertiser has come to grief by not knowing what the English call things and the committee which is preparing for the coming International Advertising Convention in London has filled what the advertisers believe is a long-felt want by preparing a glossary of business English in England.

Other Differences

This glossary shows that "Main Street" in America is "High Street" in England; that "suspenders" are "braces"; that wood alcohol is "methylated spirits"; that cotton is thread, not raw cotton; and a myriad of other articles have names different in England from their American appellations. One might almost say that there are a billion such differences, but billion in Britain means a million million, not a thousand million as in America.

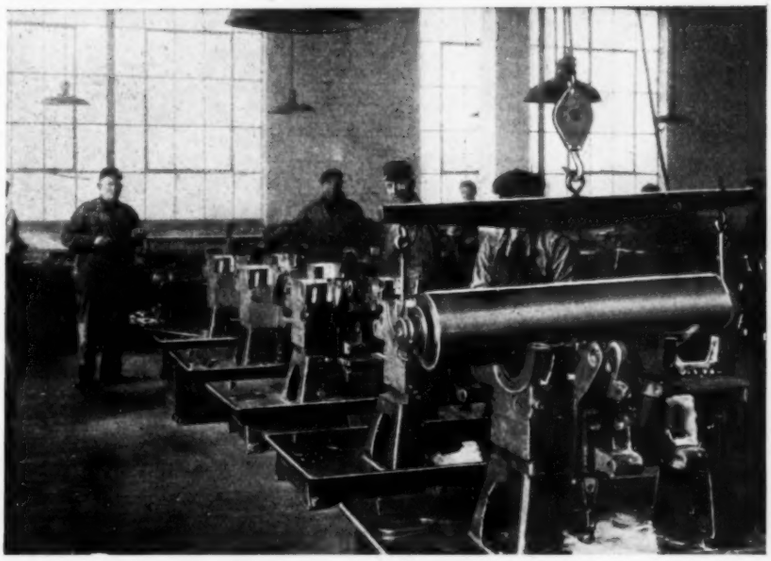
These idiosyncrasies, which may seem trivial, are really important in proper advertising in England. Any American exporter or advertiser, says Mr. Smith, will find a technical knowledge of them of great value in better marketing of his wares in the United Kingdom, and he urges serious study of this phase of English speaking unity.

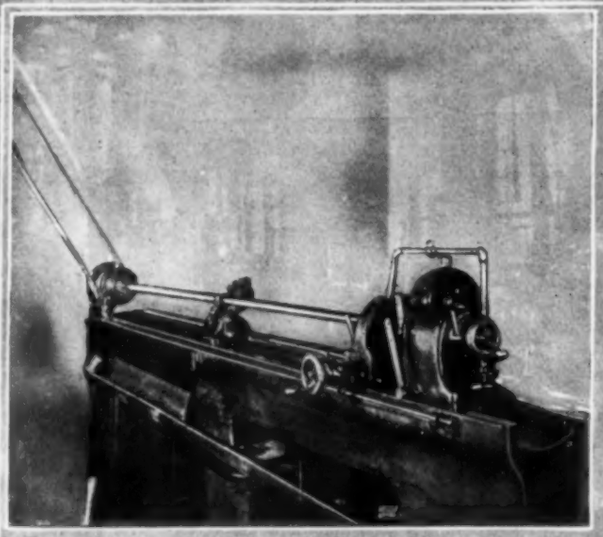




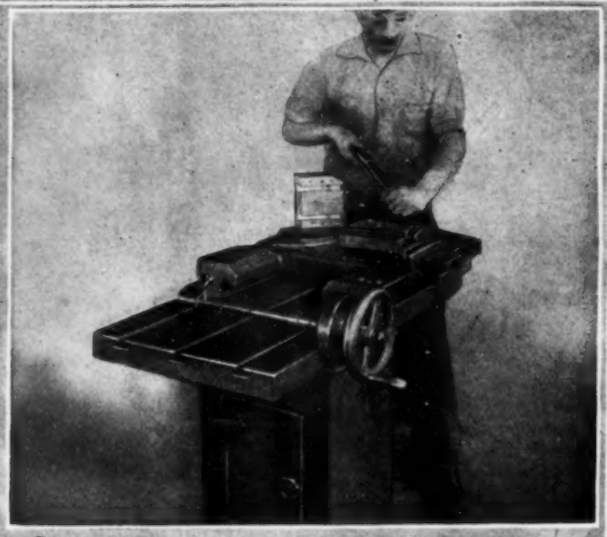
Where Machine Tools Are Made

Davenport Machine Tool Co., Inc.
Founded 1900

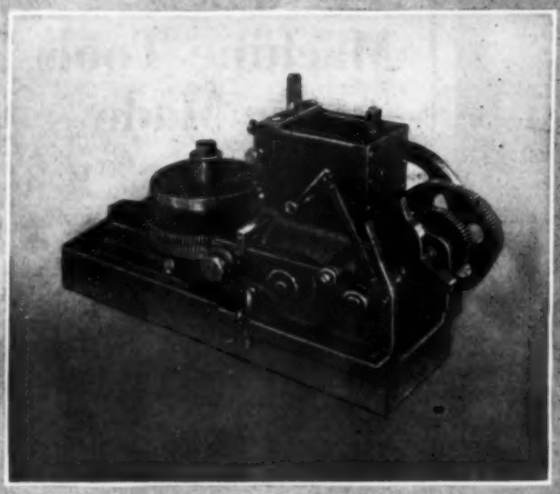




CUTTING LEAD SCREWS IN A PRATT & WHITNEY THREAD MILLING MACHINE



SCRAPING THE BEARING FOR A COMPOUND REST



AUTOMATIC MACHINE FOR GRADUATING MICROMETER DIALS

Accuracy Breeds Accuracy

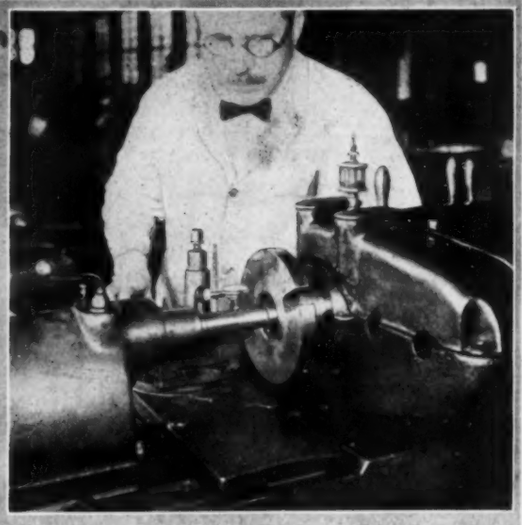
The illustrations on these two pages have been grouped to show some of the accurate workmanship and careful tests on a standard lathe during its manufacture. With this picture of care and skill before him the man who sets up the lathe in the customer's shop has no excuse if the machine fails to produce accurate work because of his carelessness. If he does his job there will be no need to call on the maker for a service man.

Photographs by courtesy of the Reed-Prentice Co.

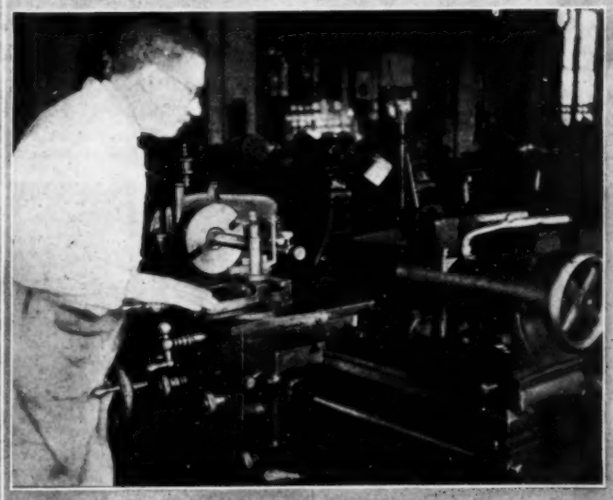
CUTTING RACKS IN A SPECIAL MACHINE

EQUIPMENT USED TO SECURE ACCURACY IN CARRIAGE ASSEMBLY

MAKING SURE THAT THE CROSS-SLIDE IS AT RIGHT ANGLES TO THE SHEARS

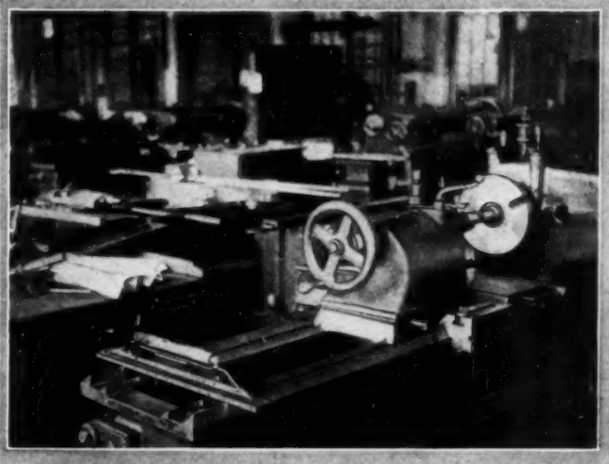


TESTING SPINDLES FOR ALIGNMENT

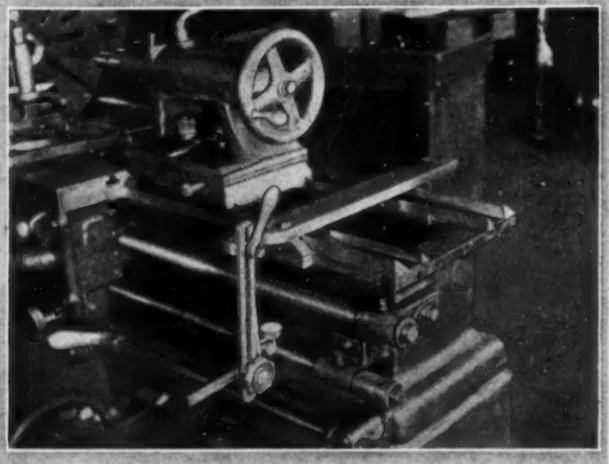


CHECKING PARALLELISM OF SPINDLE AND SHEARS

TISSUE PAPER TEST OF FACE PLATE AFTER IT HAS BEEN FACED OFF IN PLACE "SQUARENESS" OF CROSS-SLIDE IS THUS CHECKED



THE BED MUST BE LEVEL IN EVERY DIRECTION WHEN TESTED AND WHEN SET UP FOR USE

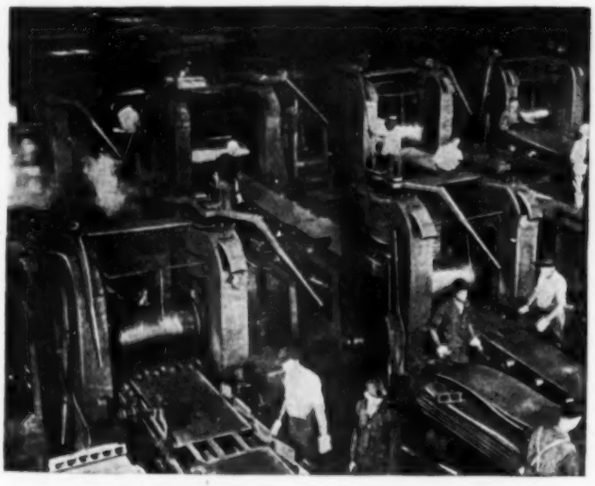


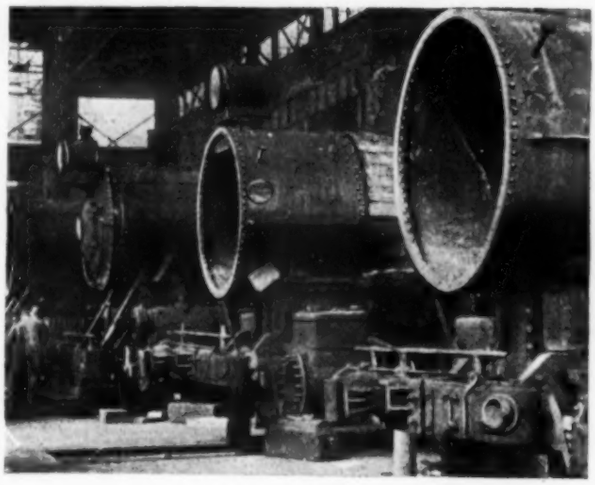
TESTING LEAD SCREWS AND FEED RACK FOR PARALLELISM WITH SHEARS

How Will They Look 5000 Years Hence?

Enlargements from an industrial film that is to be sealed in a Smithsonian Institution vault for at least 5000 years. Steel and rolling mill operations and ship and locomotive fabrication are shown

Courtesy of Rothacker Film Co.





Industrial Cost Accounting for Executives

By Paul M. Atkins

Concluding article—Factory control by means of cost accounts—Review of the subject matter of all the preceding articles—Analyzing the qualities of an executive

WE HAVE now come to the concluding article of this series dealing with the subject of cost accounting. The first article was devoted to a glance at what was to follow and it may be appropriate, therefore, to give a part of the last to a look back over what has gone before.

It should now be more clearly evident that the cost accounts and records are essentially a part of the system of factory control and form an intermediate link between the production schedules and records and the financial accounts. Under no circumstances should there be set up an independent combination as is sometimes advocated. This is one of the most important points which ought to have been gained from a reading of the articles.

Because the cost accounts are a record of what goes on in the factory it should be clear that a thorough knowledge of manufacturing processes is one of the essentials without which an adequate cost accounting system cannot be built up. It is not enough to have a general idea from reading of the operation of a factory; it is important to have actual contact with the work, though, as it was pointed out in one of the early articles, it is not essential that the cost accountant shall be an expert factory executive, or have the thorough technical training which the factory managers should possess.

The interlocking character of the cost records themselves is another factor which should be appreciated from the study of the articles. Materials, for example, were treated early in the series and yet it will be remembered that the cost of worked material could not be obtained without taking into consideration the value of the earned burden which was to be allocated to it, and the whole question of expenses and burden was not discussed and could not be discussed until some steps had been taken to record material costs, for material costs form a part of the expenses and hence of the burden. This interweaving of the cost records is shown in the chart forming a part of the fourth article and the reader who has it at hand would probably appreciate more fully now the significance of the interlocking system of lines which are shown thereon than he did at the time when he first looked at it. It is quite possible to avoid a large amount of the indirectness which frequently exists in many cost systems but the elimination of all doubling back often means inattention to important details or a failure to grasp some of the fundamentals of sound cost accounting.

> A COST system is a tool for providing information and gathering together a record of events so that the executive may get easily and quickly some of the essentials which he needs to round out his business experience. It is not a substitute for good judgment, though it often supplies danger signals of various kinds which serve to warn the intelligent man of impending danger. It is not a substitute for foresight, but it does help to furnish a history of the past in such a form that the future may be forecasted on a basis of facts so far as they may be ascertained, and the estimate of the future can be based on as firm a foundation as it is humanly possible to provide.

The problem of material inventories was taken up in the discussion of material records. It represents one of the most difficult questions which is ordinarily met in the control of the modern factory. The annual or semi-annual physical inventory is satisfactory only under a rather limited range of circumstances and some other method must be found to meet the situation. The key to the solution is the correct pricing of material withdrawn and the recording of the withdrawals daily so that a balance of the inventory account may be obtained in much the same manner as the balance of the cash account.

As we pass on to the labor records, attention should be called once more to the importance of the method of wage payment used on the cost of keeping the payroll. Whenever the cost department has the task of making up the payroll this question has considerable influence over the expense of operation of the department.

When we approach the matter of expenses we find the necessity of a knowledge of the organization impressed upon us. The expense accounts ought to serve as one of the means of fixing responsibility and of measuring the worth to the company of the department heads. Combined with this necessity is that of providing a means for the correct allocation of the proper share of the cost of the operation of the business to the product which is made during any period. The desired results in these respects cannot be gained unless the business has been properly functionalized and the expense accounts have been laid out to follow the lines marking the functional divisions of the company. These points

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were strongly emphasized in the articles dealing with the topics in question but in this final article attention needs to be called to them once more with renewed emphasis, not only because of their importance but also because they are so frequently overlooked.

Interest as an element of cost was discussed briefly and the effort was made to present both sides of the question although it was pointed out that the weight of the evidence seemed to incline toward one side. The executive is the one to decide the matter, for the inclusion or exclusion of interest very largely depends on his own particular point of view. It is hoped that the relative importance of the whole question will be appreciated as very small when compared with other problems which are met with in the cost-accounting field.

Services Rendered

The distribution of expenses to form the burden which either the product or the business as a whole must bear is a point which deserves serious consideration from the cost accountant. It is hoped that the fundamental soundness of the use of the "service rendered" principle as a basis for the distribution of expenses has been grasped and understood. Many practical difficulties are usually met in trying to put that theory into practice but experience has shown it to be sound and for that reason the effort should be made to use it. It furnishes another factor of control of the business in the hands of the executive who wishes to measure with relative accuracy the cost of making his product.

There are several different methods of allocating that portion of the burden to the product which measure the value of a service rendered in its production. The allocation of burden to the goods manufactured only in proportion to the benefits they receive in going through the factory is a fundamental principle of sound cost accounting. It must not be neglected. The methods to be employed will vary according to circumstances and the effort has been made to indicate the possibilities and limitations of some of the better known and more commonly used methods. The percentage on direct labor hours or cost method has been necessarily condemned in some instances and too unrestrainedly advocated in others. Its real worth has seldom been correctly evaluated and it is hoped that something has been done to place it in its proper position.

There is little use in arranging methods for the accomplishment of certain results if the necessary steps are not taken to make them effective. Several articles, therefore, have been devoted to the work of the cost department, dealing not only with the routine operation but explaining certain means, mechanical and otherwise for aiding in that work. One of the most important of these is the matter of the adequate instruction of the employees. It is seldom that enough emphasis is laid on this very vital problem, for the best of plans cannot be made effective if the workers through whom they are to be carried out have not been adequately taught and are not imbued with the desire to accomplish their tasks. In no small measure is the latter dependent on the former for few can be expected to give their energy to a task which they do not understand.

In recent years a great deal has been written and said and not a little has been done with what is often called—personal work—and attention has been given to the question of training departments. Much of what has been done is excellent and commendable, but it should not be forgotten that a large part of the worthwhile instruction can best be given "on the job" by those whose task it is to supervise it. This holds true in the cost department quite as well as in the factory and is a matter which requires the consideration of executives whether they hold high or low positions with the company.

Since the relative worth of any cost system in operation depends not only on the design of the system but on the men who are to operate it, it may not be out of place in the closing paragraphs of this article to say a word or two about executives, remarks which apply equally well to the cost accountant and the general manager.

Men are usually paid for what they do, for what they know, for what they decide or for a combination of some or all of these qualities. It is interesting to note that those who receive the largest rewards are the ones who are paid primarily for what they decide. Of course, this implies some action on their part and not a little knowledge.

Wise decisions are really the expression of good judgment whether those decisions relate to questions which arise in the operation of a cost department, in the design of the methods to be employed therein, or in the use of the information supplied thereby in the direction of the affairs of the company. Good judgment is the result of several things. One of these is training and the question of training has already been discussed in this and preceding articles. It is seldom that the untrained man can develop that degree of good judgment which will enable him to decide properly the more important business questions. A great deal of education is informal and is not obtained from schools or books, but it is effective nevertheless. It borders on the edge of what may better be called experience.

Experience a Factor in Good Judgment

A man may be excellently trained, may have delved deep in the accumulated knowledge of the past, may have stored up in his mind a large number of facts and the relation between them, and yet his judgment may be very immature. This is due to the fact that he lacks experience, that intimate contact with practical problems for which no amount of training or native ability is a substitute. Experience, however, is something more than making contacts and observing events. There are any number of people who have had unlimited experience measured in these terms and yet their judgment is something no one cares to rely upon. Experience also consists of the selection and assimilation of the essentials of the contacts made, the events observed and taken part in and the relations which exist among them. The experienced man is the one who not only has observed carefully and remembered, but the one who has classified what he has seen, related cause and effect, analyzed and measured and has made the essentials of his experiences a part of his mental and moral equipment. When a decision becomes necessary he is able to call upon a judgment and discretion founded on thorough training and ripened by wide experience.

The executive must appreciate the fact that a cost system, like any other mechanism which exists in connection with a business, is nothing more nor less than a tool, a machine which is there to be used by him.

It may be well or ill adapted to the uses to which it is to be put, but of itself it can accomplish nothing, not even keep going. Managers, when they blame their cost systems for failure in some respect, should remember this for the fault is more theirs than the system's. Either the system is not adequate because they have not made it so, or because they have not selected the proper persons to perform the task for them, or else they themselves do not know how to use it and hence they are not obtaining the benefits which exist therein for them. In any event the fault is theirs, not that of the records.

A cost system is a tool, then, for providing information and gathering together a record of events so that the executive may get easily and quickly some of the essentials which he needs to round out his business experience. It is not a substitute for good judgment though it often supplies danger signals of various kinds which serve to warn the intelligent man of impending danger. It is not a substitute for foresight, but it does help to furnish a history of the past in such a form that the future may be forecasted on a basis of facts so far as they may be ascertained, and the estimate of the future can be based on as firm a foundation as it is humanly possible to provide.

The Influence of Character

It is rather curious to note that in discussing the necessary qualifications for executive positions, emphasis is laid on training and experience and yet when practical business men are asked what are the qualities which they consider the most important in persons whom they desire to have as assistants, the great majority relegate education and experience to the background and stress those characteristics which we ordinarily consider moral rather than intellectual. This fact is substantiated by the results of a questionnaire sent out by one of our great engineering societies a few years ago to its members. The results of some eight thousand replies indicated that the respondents laid three times as much emphasis on what is customarily termed character as on training and experience. In other words, they based their selection 75 per cent on what they believed a man to really be and only 25 per cent on what he had learned.

Of course, a man without training and experience will not be able to accomplish very much unless he has a part of the 25 per cent representing experience and training. The acquisition of the latter qualities is far easier than the former, and they are far more easily hired on the open market. It is evident that the really effective man is the one who combines both character and trained intellectual capacity.

It has often been remarked that the person who reads a book is very much in the position of one who converses with the author. Unfortunately, a "conversation" of this kind is a rather one-sided affair. It is impossible for the listener to interrupt and ask questions, to indicate that he is quite familiar with the phase of the topic under discussion or to say that the explanation offered concerning some point has not been grasped. It is hoped, therefore, that the reader of these articles will be indulgent if they do not contain all that he would like to see therein, or omit points which he would prefer to see discussed. The effort has been made to set down certain facts and theories which have survived the tests given them in the hope that some may be benefited thereby.

Fixture for Machining an Exhaust Elbow

By George D. Wright
Surbiton, Surrey, England

THE fixtures illustrated and described herewith were made for completely machining the exhaust elbow, shown in Fig. 1, of a two-stroke motorcycle power unit. Care was taken to insure that, when the elbow was located in the fixtures, the material on the piece would be evenly and properly distributed.

The machining operations on the elbow are as follows:

(1)—End mill flange face *A*.
(2)—Drill two bolt holes *B*.
(3)—Spot-face backs of bolt hole bosses *C*.
(4)—Bore end *D* as shown.

In Fig. 2 is shown the fixture for operation (1), for end milling the face of the port and flange. A vertical milling machine would have been more suitable for this operation, but as none were available the work had to be performed on a horizontal machine—and on a poor one at that.

It will be noticed that the end to be bored is located by scissor-type Vs *A* at the top of the fixture. The position of the face to be machined is governed by the combined V-block and cutter-setting block *B*, kept 0.010 in. inside the drawing dimension of the work and likewise this amount clear of the cutter. The adjustable

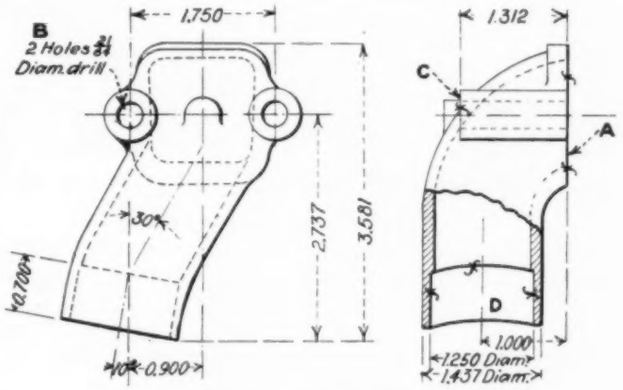

Fig. 1—Exhaust elbow to be machined

V-block securely clamps the piece, while the fixed V-block supports all the thrust of the cut.

Further, to insure that there is not too much material left on to be spot-faced from the back of the bolt bosses, the stop screws *D* which bear on them are set and locked in the necessary position. The part is pushed up against these stops when the fixture is being loaded, and held there by hand until it has been gripped between the Vs.

The jig used in operation (2) for drilling the two bolt holes is shown in Fig. 3. In this fixture the flange is located between two Vs. One V-block *A* is movable by means of a screw; the other *B* is fixed, but made adjustable so as to suit each batch of castings, should different batches vary slightly in dimensions.

The end of the elbow to be bored later is located sidewise, also by means of a scissor-type clamp *C* similar to that on the milling fixture. This location takes care of the distribution of metal surrounding the bore during the drilling operation, so that the wall will be of uniform

thickness when the piece is bored in the subsequent operation. The elbow is held to the jig by an ordinary clamp *D*, and the jig is then turned over and stands on the four feet for the drilling operation.

The third operation requires no fixtures, for the backs of the bosses are spot-faced as regards depth to a limit gage, in conjunction with the stop set on the drilling machine spindle.

Coming to operation (4), it was possible to use an extremely simple lathe fixture, Fig. 4, for boring the end of the elbow. The simplicity of this fixture is made possible only by taking care of the essential locating points in the earlier operations, and so eliminating what might have been a difficult chucking operation at this point in the process of machining.

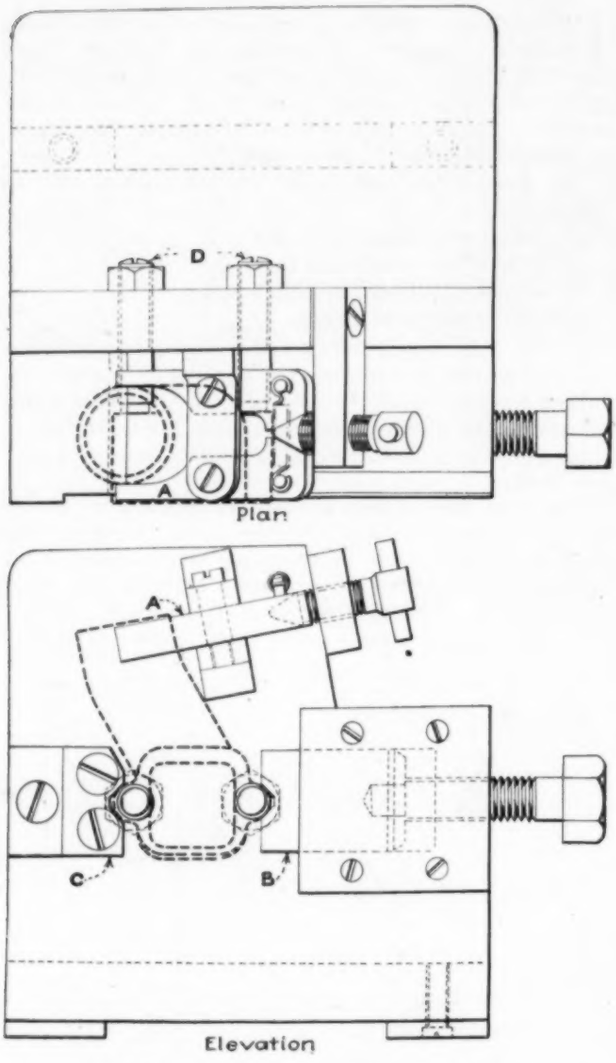

Fig. 2—Fixture for milling the flange

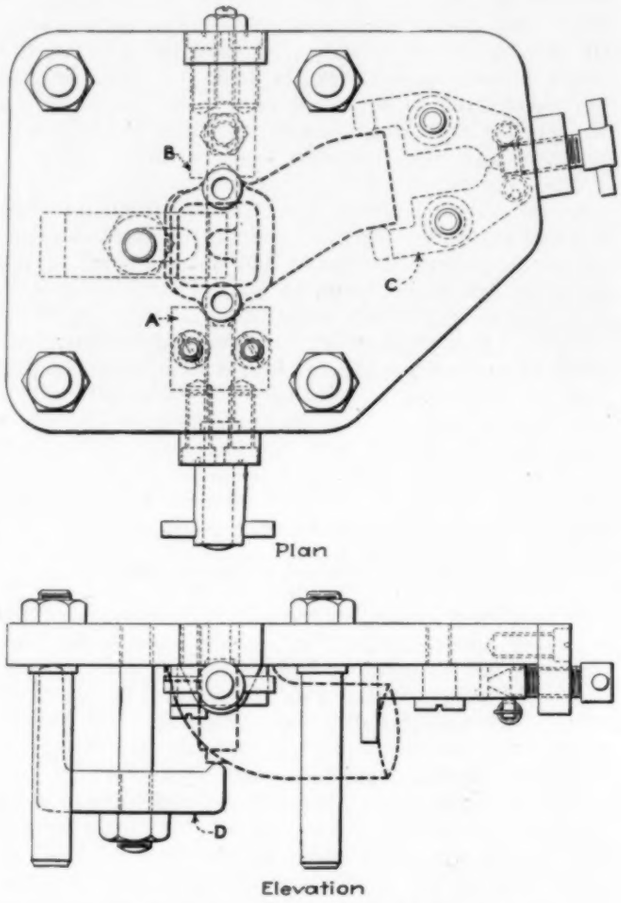

Fig. 3—Drill jig for accurately locating bolt holes

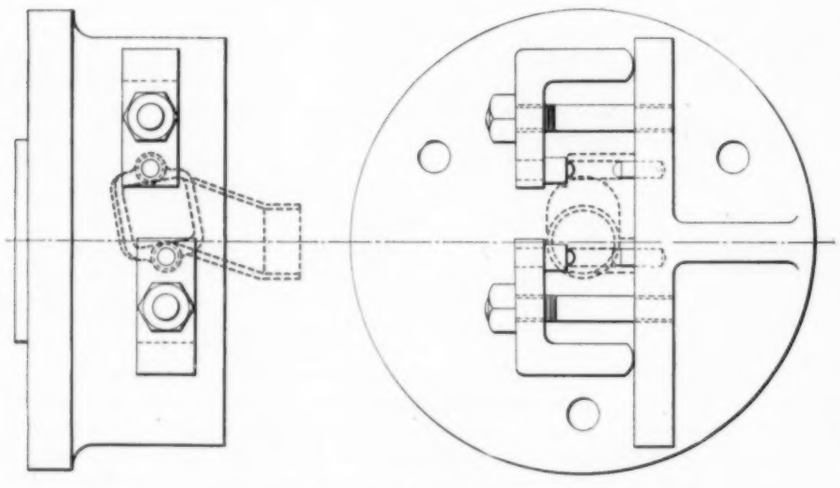

Fig. 4—Lathe fixture for boring the end of the elbow

As it was necessary that the angularity of the bore and its height fom the center should be approximately correct, and at the same time for considerations of appearance and strength have the metal surrounding the bore evenly distributed, it paid to have the earlier fixtures more complicated. One felt sure then that if the piece came out correctly in the first two operations, it would be likewise during the last operation, and that the irregularities in its form due to molding would be entirely compensated for. The operation of the fixtures bore out this assumption, since castings with considerable variations in dimensions were machined in a satisfactory manner. The design allowed a maximum variation in the castings.

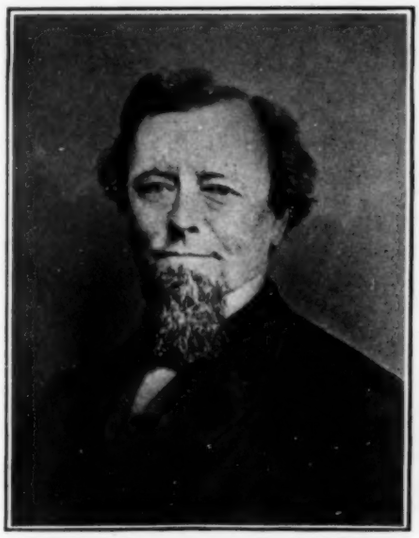

Fig. 101—*Samuel E. Robbins*

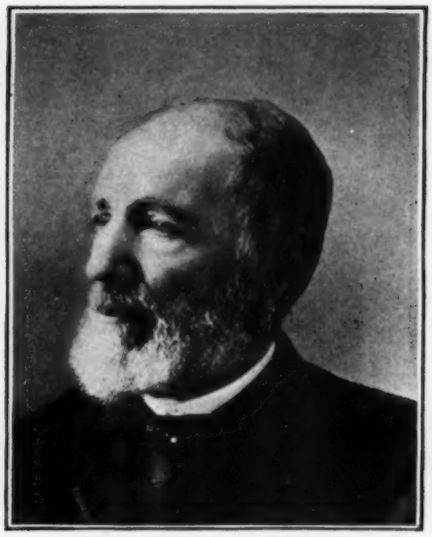

Fig. 102—*Warren Currier*

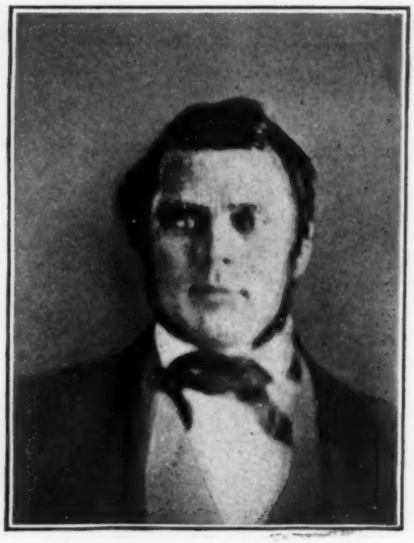

Fig. 103—*Sewell F. Belknap*

Development of Machine Tools in New England

By Guy Hubbard

The fifteenth article — Officers of the Robbins & Lawrence Co.—New England mechanics who have made names for themselves in the mechanical world

IN DEVELOPING the business from a backwoods gun shop to an industry of international repute within a period of twelve years, the founders of the Robbins & Lawrence Co., who were themselves in 1844 scarcely known beyond the limits of their Vermont village, not only developed themselves, but in doing so apparently acted as an inspiration to numerous individuals who had come to them as obscure journeymen and apprentices. A surprising number of the members of their industrial "family" have—as mechanics, inventors and business organizers—left a strong and permanent impress upon the history of the mechanic arts. The lives of these industrial pioneers are almost invariably stories of early poverty and hardships; of school days cut short by the necessity of going to work; of three or four year apprenticeships marked by long hours, hard labor and meagre pay—but shining through all this darkness was that light of inventive genius and ambition to achieve, which made the Yankee mechanics the leaders in their field. The biographies of some of these men should inspire those practically trained readers whose educational advantages have been limited.

Samuel E. Robbins, whose portrait is shown in Fig. 101, was the promoter and first president of the Robbins & Lawrence Co. Born at Boston, Mass., in 1810, he received his education in the public schools of that city. Early in life he went into the lumber business and became one of the successful lumber operators of Bangor, Me., and of Boston, in which business he amassed a considerable fortune.

His wealth enabled Mr. Robbins, in 1843, to retire upon a large estate two miles below Windsor Village, where he established himself as a gentleman farmer, but being brought in touch with Kendall & Lawrence, he went into partnership with them in the winter of 1844 and from that time until 1856 was the business manager of the Robbins & Lawrence armories at both Windsor, Vt., and Hartford, Connecticut.

For some time previous to 1856, Mr. Robbins had his main office at the Hartford plant, and resided in that city. Upon the failure of the Robbins & Lawrence Co. at Windsor in that year, he returned to Windsor and helped to organize the Vermont Arms Co., leasing the Robbins & Lawrence shops in order to complete the partly finished Enfield rifles and to build a new sewing machine, of which more will be said later.

In 1858, Mr. Robbins sold out his interests in the Vermont Arms Co., and in 1860 organized a company at Boston for the manufacture of a new eyelet tool, a successful business which he sold to his brother in 1870. In that year Mr. Robbins moved to Brooklyn, N. Y., giving his attention to the promotion of a zinc

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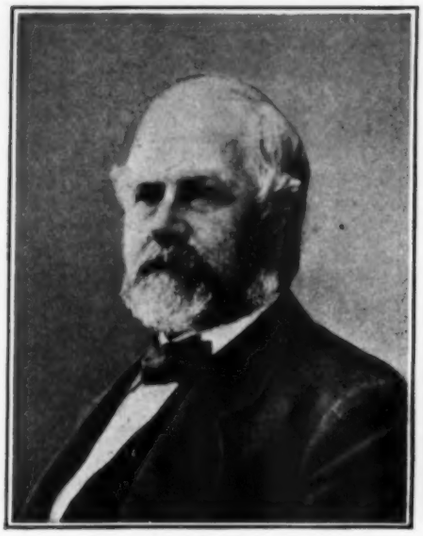


Fig. 104—*Richard S. Lawrence*

Fig. 105—*Frederick W. Howe*

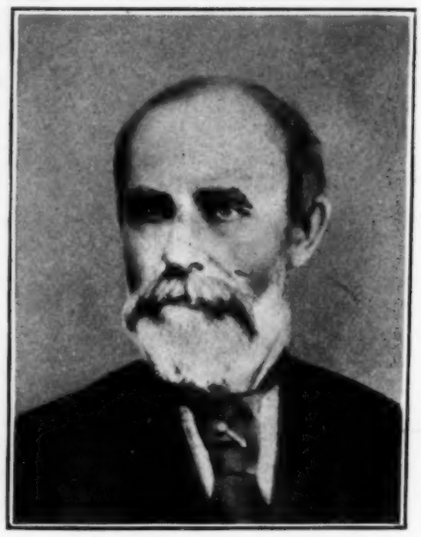


Fig. 106—*Henry D. Stone*

company in Tennessee, and a "two-stave barrel" manufactured at Shandaken, N. Y. Mr. Robbins died suddenly at Shandaken in 1874. He was essentially a promoter and speculator rather than a mechanic, and while his business methods may appear to have been somewhat careless, he nevertheless deserves great credit for his energy and ability as an organizer, which made possible the rapid expansion of the Robbins & Lawrence and Sharps Companies.

Warren Currier, a portrait of whom is shown in Fig. 102, one of the original incorporators of the Robbins & Lawrence Co. and who succeeded Mr. Robbins as business manager and president, was born at Walpole, N. H., in 1817. His father died when he was eight years old, and as this broke up the home, Warren went to live with an uncle. At the age of fourteen Warren Currier struck out for himself—determined to get an education. He studied Greek and Latin at Kimball Union Academy, Meriden, N. H.. and completed his studies at the Literary Institute, New Hampton, N.H.—working his way through by his own efforts. He says of this period, "When I was fourteen I milked eight cows night and morning for a while, and did it well, working for six dollars a month and board in summer, going to school and doing my chores for my board in winter, taking rank there among the best. That way of life in the actual experience of it may seem hard and rough, but it pays. Those who started far ahead of me, I left so far behind that they were out of sight years and years ago. The truth is that work pays, and it is only by work, mental or physical, or both, whereby anyone attains to a real manhood."

Efforts to Save the Business

After leaving school Warren Currier entered the law office of Aiken & Egerton at Windsor, Vt., and in 1841 was admitted to the bar in Windsor County. When the Robbins & Lawrence Co. got into business difficulties, Mr. Currier made determined efforts to save the concern, and his election as president of the company, in 1856, showed the confidence placed in him by the stockholders. When he saw that it was impossible to bring the company through, he immediately became one of the incorporators of the Vermont Arms Co., and thereby kept the wheels of industry turning at Windsor.

In 1857 Mr. Currier moved to St. Louis, where he resumed the practice of law. In 1864 he was elected to the Missouri legislature and served as chairman of the ways and means committee during the difficult wartime days. From 1868 until 1872 Warren Currier served as one of the judges of the supreme court of Missouri.

Judge Currier always retained his interest in manufacturing and from 1872 until 1875 he served as president of the Missouri Car & Foundry Co., one of the earliest and largest machinery concerns of St. Louis. He was a founder of this pioneer industry and did much to build it up, thus contributing very materially toward making St. Louis an industrial center. Judge Currier died at Lithia Springs, Georgia, in 1892.

From Laborer to Engineer

Nor should we omit to mention that dashing "financier-engineer"—Sewell F. Belknap—sometime a silent partner in the firm of Robbins & Lawrence—a gentleman who will serve as a connecting link between the business men who have preceded and the mechanics who will follow.

Sewell Franklin Belknap, see Fig. 103, was born on a farm in Dummerston, near Brattleboro, Vt., in 1812, and received his education in the district schools of that neighborhood. After working on his father's farm for some time he became dissatisfied with the prospects, and, in 1836, he went to Boston to seek his fortune.

Starting out as a common laborer on the construction work of the Eastern Railroad between Boston and Salem, he rapidly rose to the rank of engineer and contractor, and as such, executed several large contracts on both the Eastern and the Boston & Maine Railroads. Upon the completion of these contracts Mr. Belknap, under the name of Belknap, Gilmore & Co., undertook the contract for the entire line from Portsmouth to Portland, a distance of fifty miles, and carried it through with remarkable success. Having completed the Portland, Portsmouth & Saco line, his next step was to undertake the Fitchburg, which was languishing. He immediately raised $650,000, took over the whole enterprise, and pushed it through to completion, making a clear profit of $200,000. At the same time he car-

ried out the building of the old Colony Line of thirty-eight miles.

It had always been Mr. Belknap's ambition to push the railroad up among his native Vermont hills, and he therefore seized the opportunity to take the entire contract for the Sullivan, and Vermont Central lines of 140 miles, personally taking one quarter of the stock and entering into contracts to the extent of fully $3,000,000. Mr. Belknap pushed forward these contracts with great ardor and skill, and in order to be close to the scene of operations, he moved to Windsor, Vt., where he purchased the mansion built by Thomas Emerson, and took his place—both socially and financially—as the leading citizen of the town. It was then that he became connected with the Robbins & Lawrence Co. as silent partner in the railway car business, and had Mr. Belknap lived, this branch itself might well have developed into a large industry.

As a result of his strenuous labors, he fairly wore himself out and died quite suddenly in 1849 at the early age of thirty-six years.

Of the engineers and mechanics of the Robbins & Lawrence Co., Richard S. Lawrence holds first place, for to him more than to any other person belongs the credit for the fame of this concern.

Early Life on the Farm

Richard Smith Lawrence, see Fig. 104, was born on a farm in 1817 at Chester, Vt., about twenty miles west of Windsor, his father removing to Mounsfield, Jefferson County, N. Y. when Richard was about two years old. After a bitter struggle with the wilderness, the elder Lawrence died when Richard was nine years old, leaving a wife with three young children, and no means of support. This misfortune broke up the family, and ended Richard's few months of schooling, as from that time forward the boy was forced to work for his living.

After six years as a farm hand, Richard was bound out to his grandfather, Judah Lord of North Watertown, who was making carpenters' and joiners' tools. He served his time for a year on such hard work as sawing out seasoned beech blocks for planes, but in spite of such an uninteresting start he determined to become an expert in mechanical lines. He had as pay, only his board and clothes, and in order to get a little spending money he made packing boxes for a near-by paper mill—often working half the night for 25 cents. It fortunately happened, however, that there was in the basement of Judah Lord's building, a well equipped custom gun shop, run by a young mechanic who, after hours, took pains to instruct young Lawrence in the finer trades of gunsmith and machinist.

During the business depression of the thirties, Richard Lawrence was forced to serve at different times as a maker of sash and doors, as a workman in a dusty rope and plaster mill, as a bartender and hostler in his grandfather's tavern, but finally terminated this uncomfortable period of his life by being drafted into the United States Army and serving three months guarding the Canadian border during the Rebellion of 1837.

After his honorable discharge from the army at the age of twenty-one, he set out for Brownsville (West Windsor) Vt. where his uncle Asa Story had a custom gun shop. He worked his way to West Windsor, traveling by freight wagons, Erie canalboats and by the Green Mountain stage—the trip to Brownsville consuming nearly two months, which included periods of working to replenish his pocketbook.

Mr. Lawrence removed to Hartford in 1852, and in that city he resided for the rest of his life. Until 1856 he divided his time between the Windsor armory and the Sharps plant, but from 1856 until 1872 he gave his time wholly to the Hartford enterprise—for the success of which he was largely responsible.

After leaving the Sharps Co., Mr. Lawrence entered actively into the civic affairs of Hartford. He died in 1892 at his home in that city.

One of Mr. Lawrence's sons, the late Ned Lawrence, succeeded his father as one of the leading Hartford mechanics. Learning his trade under his father's able tutelage, Ned Lawrence came to be superintendent of the Pope Manufacturing Co. during the days when that concern was building motor cars in what had once been the Sharps plant.

Of the Robbins & Lawrence mechanics, the most famous, after Mr. Lawrence, was Frederick W. Howe, of whom Professor Roe says, "He left a deep impress on mechanical development in this country . . ."

Fig. 107—H. B. Smith

Frederick Webster Howe, whose portrait may be seen in Fig. 105, the son of a blacksmith, was born in 1822, at Danvers, Mass. After attending the common schools there until he was sixteen, Frederick Howe, in 1838, entered the famous Silver & Gay shop at North Chelmsford, Mass., as an apprentice, learning the machinist's trade, building textile machinery and machine tools. Here under the instruction of Zeba Gay, Mr. Howe later learned drafting and machine design, and became highly proficient in these arts. There were in the Silver & Gay shop at that time, various curious and novel machine tools, some of which had come from England and others that had been designed and built in the shop. The influence of these machines upon the later work of Frederick Howe was plainly marked, and it was through Mr. Howe more than any other man that Silver & Gay exerted such an influence upon industrial development.

When Robbins, Kendall & Lawrence began to gather together its force at the Windsor armory, Frederick Howe was one of those who answered the call—going to Windsor in 1847 and immediately becoming the right-hand man of Mr. Lawrence in the designing of machine tools, and their work between 1847 and 1852 was so closely allied that it is almost impossible to divide the credit. Mr. Howe's progress was rapid, and in 1848, at the age of 26, he was made superintendent of the Robbins & Lawrence machine shops, a position which he held until 1856, during which time he and Mr. Lawrence brought out numerous new and improved machines. Among these machines may be mentioned, sensitive drills with from one to six spindles, large drill presses with back gears and power feeds, combina-

tion tapping and threading machines, barrel boring machines, rifing machines, the plain milling machine, the profiling machine, the universal milling machine, and the modern turret lathe. Mr. Howe, during this period, was one of the first designers to break away from architectural designs in favor of the sensible box frames such as are now universally used.

In 1856, Mr. Howe went to Newark, N. J., and was designer and superintendent of the Newark Machine Co., manufacturer of machine tools and gun machinery, where he continued to build his universal milling machines. In 1858, he went to Middletown, Conn., where he was engaged with North & Savage in the manufacture of guns and gun machinery on contract until the outbreak of the civil war.

In 1861, Mr. Howe went to Providence, R. I., and became associated with the well-known Providence Tool Co. (now the Rhode Island Tool Co.), as superintendent of their armory at a salary of $5,000 a year. He remained with that company throughout the civil war, bringing its manufacture of Springfield rifles to a high point of efficiency, and beginning the manufacture of the famous Peabody breechloader. Many of the machines built by him are still in use at that plant. It was during this period that Mr. Howe became acquainted with Joseph R. Brown, of J. R. Brown & Sharpe, and in 1862, Mr. Brown built the first Brown & Sharpe universal milling machine for Mr. Howe—it being originally used to flute the twist drills used by Mr. Howe at the Providence Tool Co.'s shops.

Sewing Machines Built on the Interchangeable System

In 1865, when the government rifle contracts were closed, Frederick W. Howe went to Bridgeport, Conn., under contract with Elias Howe, the sewing machine inventor, to build up the economical quantity manufacture of the Howe sewing machine. The old Elias Howe factory was leased to Frederick Howe for this purpose, and he also began the construction of a large new plant which he designed especially for sewing machine manufacture by the interchangeable system. He had just begun to employ 2,000 hands in this new plant when, in 1867, the famous sewing machine inventor died. The company was reorganized, and Frederick Howe left it to return to Providence.

In 1868, by invitation, Mr. Howe went to Brown & Sharpe's at Providence, to assist the rapidly aging Joseph R. Brown as mechanical engineer—Mr. Brown having developed a high regard for him during their associations while Mr. Howe was at the Providence Tool Co. In 1869, Mr. Howe and Thomas McFarlane, the superintendent, became partners in the firm of Brown & Sharpe and, after the incorporation of the Brown & Sharpe Manufacturing Co. in 1869, Mr. Howe was for two years its president, and was owner of three sixteenths of its stock, which was turned over to him by Mr. Brown from his own holdings.

Mr. Howe was active in this great concern from 1868 until 1873 and retained certain interests in it until 1879. During that time he designed and superintended the building of the first of the present shops. He was very exacting in his requirements in the building of the plant, for he did not allow even a single brick to be misplaced. Mr. Howe was a builder of accurate mechanisms, and it was his firm belief that this idea of accuracy should be built into the plant itself. He was the inventor of several of the Brown & Sharpe milling machines, one of which is still sometimes called the Howe machine. He assisted Charles H. Wilcox in the development of the Wilcox & Gibbs sewing machine, being the joint inventor of the thread tension device, and he designed the manufacturing equipment for this machine.

From 1876, until his sudden death in 1891, Mr. Howe was a consulting mechanical engineer at Providence, and as such assisted Charles Goodyear, 2nd (son of the famous inventor of vulcanized rubber) in the early development of the Goodyear welt sewing machinery. At the time of his death Mr. Howe had designed and was about to begin the manufacture of a unique one finger typewriter, which surely should have been popular among the amateur typists everywhere. Mr. Howe was, without question, one of the most brilliant New England mechanics.

Another of the notable Robbins & Lawrence mechanics was Henry D. Stone, who has frequently been called one of the improvers of Maudslay's slide rest on account of his work in the development of the turret lathe. Henry D. Stone,* see Fig. 106, who was the youngest of nine children, was born at Plainfield, N. H., in 1815, and received his education in the common schools of that village. Being of a mechanical turn of mind, Mr. Stone, like many another early machine designer, as a boy learned cabinet making, and after leaving school at the age of sixteen he went to Woodstock, Vt., in 1836, and entered the shop of R. Daniels & Co., builder of textile machinery. There Mr. Stone learned the trades of millwright, patternmaker and draftsman, remaining with this concern for about ten years.

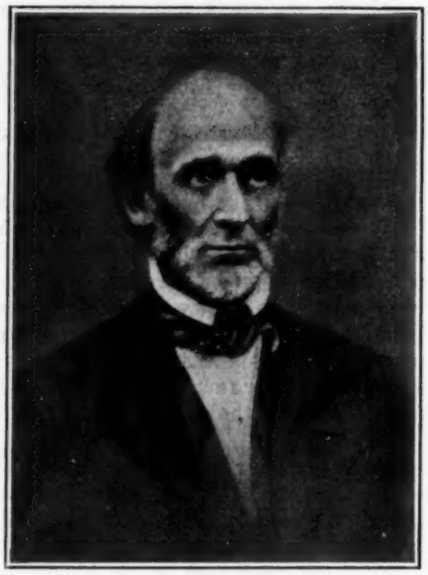


Fig. 108—Hiram Powers

In 1846, Mr. Stone went to Windsor and became a patternmaker and draftsman for Robbins, Kendall & Lawrence. Here his rise was rapid and he soon became superintendent of the rifle shop, for which he designed many important improvements in machine tools and gun machinery.

Among the numerous designs of Mr. Stone during the Robbins & Lawrence days, were gun stock lathes, rifling machines, and many of the jigs, fixtures, gages and special machines, both for the Enfield armory and for the production of the first 25,000 Enfield rifles at Windsor. A battery of twelve of the Robbins & Lawrence rifling machines designed by Mr. Stone is running today in the plant of one of the best known revolver manufacturers in the United States—rifling almost the entire output and doing, it is said, more and better work than the modern machines.

After the failure of the Robbins & Lawrence Co. in

1856, Mr. Stone joined with Mr. Robbins and others in the founding of the Vermont Arms Co. to continue the work at the plant at Windsor. From 1858 until 1885, he remained as designer and superintendent with the Lamson companies, successor to the Robbins & Lawrence Co. and the Vermont Arms Co., giving most of his attention to the development of the turret lathe. His painstaking work in this direction undoubtedly paved the way for the well known Hartness flat turret lathe, which was based by James Hartness upon the later Stone designs. Henry D. Stone died at Windsor, Vt., in 1899.

Birthplace of Famous Mechanics

Woodstock, a quiet and beautiful hill town about fourteen miles northwest of Windsor, holds an honorable place in the history of the mechanics arts. Not only did Henry D. Stone there receive his mechanical education, but it was the birthplace of three other famous mechanics—Francis A. Pratt, H. B. Smith and Hiram Powers. Francis A. Pratt, who was in 1860 a founder of the famous Pratt & Whitney concern of Hartford, was a son of a local blacksmith—one of the leading citizens of Woodstock. He moved away from Woodstock when he was eight years old and learned his trade at Lowell, Massachusetts.

H. B. Smith, see Fig. 107, founder of the H. B. Smith Machine Co., well known manufacturer of wood-working machinery at Smithville, N. J., was born on a farm near Woodstock, in 1816. He learned his trade as a cabinet maker at Woodstock, and his first invention was a machine for mortising blinds. The success of this machine started him on his career of machine manufacturing, which he commenced in Woodstock village in the early '40s. In 1847 he moved his business to Lowell, Mass., where he remained until 1865, and then in search of a larger works he located at Shrewsville, N. J. There he was successful and virtually rebuilt the town, the name of which has been changed to Smithville in his honor. He was one of the first designers to employ iron frames and accurately fitted parts, such as cut gears, in wood-working machines, and many of his designs have been adopted as standard. Mr. Smith died at Smithville in 1887, but his business is still flourishing and his wood-working machinery has a world wide sale.

Sculptor and Mechanic

The third member of this group—Hiram Powers—is widely known as one of the earliest successful American sculptors, but is probably known to but few as a mechanic. Hiram Powers, see Fig. 108, son of a blacksmith, was born at Woodstock, Vt., in 1805, and began to learn his trade there as a mechanic and a millwright. In 1819 his father moved the family to Ohio and located near Cincinnati, where Hiram worked for a time in a clock and organ factory.

At this time he first became interested in the art of sculpture, and at last obtained a situation as "artist" in the so-called Western Museum of Cincinnati, which was run by a Frenchmen named Dorfeuille. In this Museum it was customary to have lectures upon the wonders of natural (and unnatural) sciences by itinerant "Doctors" and "Professors," and it was in this connection that Powers met, and became a lifelong friend of "Doctor Coult," demonstrator and lecturer on the wonders of that new invention "Laughing Gas." This Doctor Coult was none other than the famous Col. Samuel Colt, later the inventor of the Colt revolver and the first great manufacturer of Hartford, Conn. It may be mentioned that both Hiram Powers and Col. Samuel Colt were honored exhibitors at this Exposition—the first with his masterpiece "The Greek Slave" and the last with a set of his revolvers. Mr. Powers died at Florence, Italy, in 1873.

It may also be mentioned that the Aaron W. Whitney Co. of Woodstock, through the Robbins & Lawrence Co., was brought to the attention of the British Small Arms Commission which visited Woodstock in August, 1854. As a result of this visit the Aaron W. Whitney Co. built six folding machines, two grooving machines, four burring machines, two wiring machines, four turning machines, two setting-down machines, two bending machines, six hand drills, two closing machines and two lever shears for the new Enfield armory. This was one of the earliest complete sets of modern sheet metal working machinery ever set up in England, where these designs of Aaron Whitney were widely copied.

Some Reasons for Drilling Troubles

By Roscoe A. Ammon

THE deficiencies in drilling practice in some of the large automobile plants, mentioned in the article by A. L. De Leeuw and K. H. Condit on page 683, Vol. 59, of the *American Machinist*, coupled with my own experience, lead me to one conclusion. The principal trouble is in grinding the drill.

Not one-half of one per cent of the mechanics can properly grind a drill, because they were taught wrongly, or not at all, in the first place. Many years ago someone invented a "swing-swing" drill grinder that ground drills on the side of the wheel, and every one assumed that, as the machine was designed to grind drills, it must do the job correctly. There are very few men who can grind a drill properly by hand on the side of the wheel, and I have never yet seen a drill correctly ground for heavy feeds on a machine of that type. The usual trouble is that out near the corner of the drill there is no clearance or, at least, not enough to carry a reasonable feed. Looking at the ground surface so you can see it in profile, there seems to be a pronounced hump just back of the cutting edge.

There is a new drill grinder with an oscillating motion that does a first-class job when properly operated. Yet, in the past few months I have been in three large, well-known shops that were twisting off tangs, splitting drills, wearing out knuckles on their multiples, and having a bad time in general with drills. All this trouble was occasioned by setting the drills in the grinder so that the angle formed by the cutting edges and the chisel point was about 90 deg., instead of about 125. A drill ground with a 90-deg. angle has no clearance as shown at the center and cannot cut. A split drill usually results, but the tool room men said, "That's the way we were told to grind them."

Calling the matter to the attention of executives did not have much effect because, generally speaking, executives pay little attention to the details of drilling, since it is looked on as a job that anyone can do. In one of the above-mentioned shops they had a large multiple that was having a hard time pulling twelve

1-in. drills on a flange job with only 0.005-in. feed. When those same drills were set correctly on the grinder and properly ground, the machine handled 0.015 in. feed per revolution, all there was, without any trouble.

The automobile industry, for some reason or other, has been much inclined toward the regular sizes of shanks, which were originally standardized at a time when power feeds, tough, heat-treated steels and production drilling were unknown. Using regular size shanks it is impossible to drive drills to capacity, without excessive tang breakage on most sizes. One well-known shop drills a forging with $1\frac{7}{32}$- and $1\frac{9}{32}$-in. holes in it, and the feed used is based on $1\frac{7}{32}$-in. drills with a No. 3 taper shank. They have always done it that way and they probably will for a few years more. Oversize shanks will not fit their drill grinder so, for the sake of a cheap machine, they lose more than the cost of a new and satisfactory grinder every month.

To get as much out of a drill as possible, oversize shanks must be used on most sizes. The fact that certain drill makers fought against oversize shanks for many years and now advocate their use, is pretty good evidence that, before long, oversize shanks will be adopted by all drill makers and shops for production drilling. Because of drills so ground that they could not take a heavy feed and shanks so light that tangs twisted off easily, most drill makers and shops have advocated high speeds and light feeds. However, better drill grinding, oversize shanks, and the necessity of reducing drilling costs, will probably bring more shops to the use of a conservatively high speed and a relatively heavier feed than is customary at present.

Several years ago, when one of the big producers of cars was expanding, some new equipment to machine axle parts was installed. For steering knuckles there was a line of machines from which a production of 30 complete knuckles per hr. was expected. Every machine could do it except the large three-spindle drill press for drilling king pin holes, which headed the line. The output never exceeded 15 knuckles for any hour and a drill never lasted for more than 9 holes before it was completely dull. Everyone in the department cussed the twist drill makers for not being able to produce a drill that would stand up to the machine and the job, and they were about to order an additional machine.

How the Problem Was Solved

At this juncture the mechanical man from one twist drill plant finally got into the shop and stated that the speed was too high and the feed was too low. They also had a $\frac{3}{8}$-in. pipe squirting compound on the drills and, incidentally, on anyone who came near the machine. The next lower speed on the machine was too low and the next higher feed was too coarse, so he got them to make some feed gears to give the feed he wanted for one spindle. One lineshaft pulley was changed to make the peripheral speed on that one spindle 55 ft. per min., and a larger pump with 1-in. piping was installed to give volume of compound, rather than pressure. From that one spindle they immediately got 17 knuckles per hour and the drills ran more than 3 hours without grinding. When the other two spindles were fixed the same way the average production of the day and night gangs rose to 44 knuckles per hour.

Several other tough jobs in this plant were then gone over by this man in the same way, and production was increased in each case. He spent a lot of time teaching them how drills should be ground, recommended different abrasive wheels and speeds on their drill grinder and, in general, gave valuable assistance to the shop. They started buying his drills, but there came a weakening in drill prices and some maker cut prices 5 per cent. The buyer then decided that, except for those few mean jobs, he would buy the cheaper drill, completely overlooking the fact that it had cost the drill maker a lot of money to have a man in that plant, and that he had saved many times the cost of the drills by increasing their production.

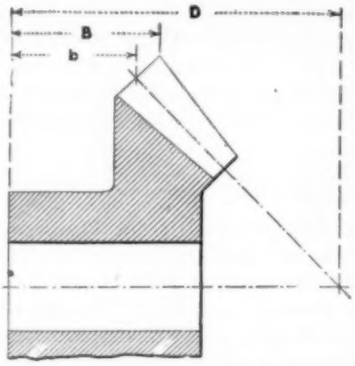
The work of the expert was lost sight of in the purely commercial side of the business. The best engineers that the automobile company could hire had decided what machinery would be bought, but the decision as to the tools to make that machinery produce was left pretty much up to a man who had been trained to buy on price or precedent, who was anchored in an office all day where he never had a chance to see for himself what was going on in the shop or hear the shop man's side of it, and who did not always realize that tools are not a basic commodity like pig iron.

Proposed Standard Nomenclature for Gearing—Discussion

By Frederick Franz

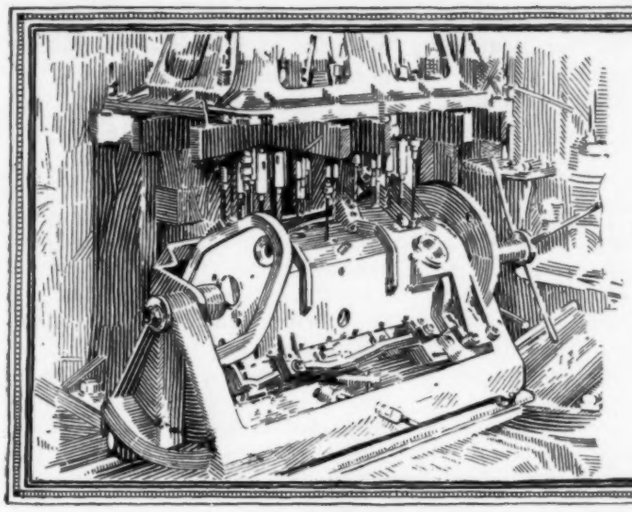
The proposed standard nomenclature for gearing, Vol. 59, page 801, of the *American Machinist*, defines "Backing," in bevel gears, as the distance *B* given in the accompanying illustration. This is a variation from the existing definition which gives it as the distance *b*. Its use as proposed will be confusing, and practically useless to all in the gearing industry except the machinist who makes the gear.

For him it will provide a means of direct measurement, which the distance *b* would not provide, but all correct bevel gear drawings give both dimensions. The machinist therefore need not be handicapped by calling *b* the "backing." At present the distance *b* is given in whole inches and vulgar fractions of an inch, facilitating the determination of the distance *D* from the center line of either shaft to the face of either bearing, when both pitch diameters and both backings are given. Assuming *B* to be standardized as the "backing," would it be in whole inches and vulgar fractions or whole inches and decimal fractions? Either way trouble would ensue, owing to the fact that it would be useless as a dimension for most users of the gears unless the distance *B* minus *b* would also be specified for each gear.



Bevel gear

This discrepancy should be carefully studied before the existing use of the term is changed. It is proposed that the definition be changed to read as follows: "Backing is the distance parallel to the axis from the plane of the pitch circle to a shoulder or hub extension."



Tool Engineering

By
Albert A. Dowd
and
Frank W. Curtis

Organization of the tool drafting department—Procedure in carrying on the work—Method of keeping record of drawings—Standardizing drawing sizes and style

IN CONCLUDING this series on tool engineering, we believe that some mention should be made of the system and records used in the drafting room. We shall also give a little general information regarding methods of making tool drawings, assemblies and details. Every manufacturer has certain ideas of his own in regard to the system best adapted to his own needs, but in general the process is much the same in all progressive and modern factories.

Let us consider first the organization of the tool engineering department, realizing that the amount of work handled in the department has a vital influence on the requirements. Assuming that the factory is a large one, there would doubtless be a tool supervisor in charge of the entire department. There would also be a chief draftsman and one or more assistants, layout men, detailers, tracers, checkers, clerks and stenographers. If we assume that the department receives from the planning department a layout of operations, together with a list of tools required, then we have only to consider the actual preparation of tool drawings ready for the shop.

The tool supervisor assists by his advice and usually controls the general design of tools, although the details are often worked out by the chief tool designer and his assistant. These assistants usually keep the men supplied with work and exercise a general supervision over the tool drafting room. If it is a very large department, it is advisable to separate the men into groups, each of which comprises one or two layout men and several detailers. If tracings are made in ink, which is not commonly done, the tracing work can be handled in a separate department if desired.

Pencil Drawings for Tools

In the majority of shops, tool drawings are made on good quality bond paper tough enough to stand considerable erasure and thin enough so that good blueprints can be made if lines are drawn in pencil. It will usually be found that a No. 2 pencil is best for lettering and a No. 3 for drawing. Lines should be made very clearly and carefully if good blueprints are to be obtained.

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The method of filing which the writers have found most convenient for this kind of work is illustrated in Fig. 585. In the first place it is necessary to obtain a quantity of large and heavy manila envelopes, open at one end and about 10x12 in. in size, like those shown at *A*. In the upper left-hand corner of these envelopes the job or order number can be printed in large figures. At the other side of the envelope the list of prints which are in the envelope can be given as shown. For a very large job a number of envelopes might be required, and in a case of this kind it would be well to use an additional number immediately after the job number, such as "Job 786-1, Job 786-2, Job 786-3," etc. One of these large manila envelopes will often hold eight or ten blueprints, unless they are very large.

Blueprints Folded for Filing

It is quite important to fold the blueprints in a uniform manner, and small enough so that they will go in the envelopes easily. If they are folded as shown in the example *B* and if each print is marked with the job number and part number as indicated, it will assist greatly in locating whichever one may be wanted. The job number should always be placed on the thick edge of the folded print and never on the side where there are several thin edges of paper as shown at *C*, for when this is done it is hard to pick out the correct print. This may appear to be a small matter, and yet it is important enough that neglect of the points mentioned may cause considerable annoyance and trouble.

A cross-indexed card record should be kept for all jobs, one set of cards being filed alphabetically, according to the customers' names, and the other set numerically, according to the job numbers. Fig. 586 shows a 3x5-in. card at *A* of a form suitable for the alphabetical record. It is advisable to place the customer's name at the upper left-hand corner of the card, and to place the address below it as shown. The card is printed and ruled so that various job numbers, dates and the kind of work can all be entered in a uniform manner. Thus, if a certain customer has a number of different jobs from time to time, they can all be entered on the card with enough information to distinguish one from the other. This particular card is not in-

tended for detailed record of the jobs, as these details are taken care of on the job card shown at *B*.

A card of this latter kind is made out for every job and is filed numerically, according to the job number which is given in the upper left-hand corner. The manufacturer's name is also noted on the card. It is a good plan to make this record card in such form that

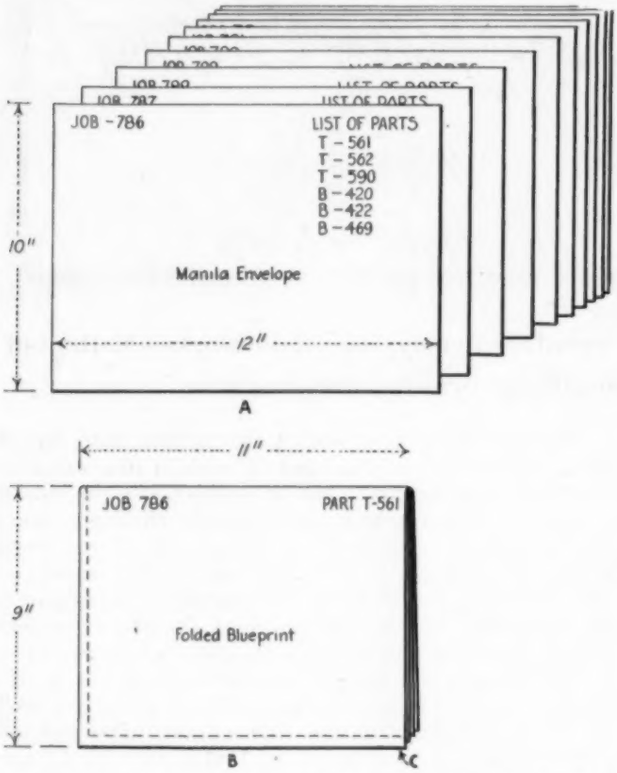


Fig. 585—Filing customers' blueprints conveniently

a brief synopsis of the job can be typewritten on it as shown. Of course there are cases when a more complete record is needed.

Let us mention briefly the ordinary methods used in making tool drawings, for although these methods vary somewhat in different drafting rooms, the general procedure is much the same in all of them. Layout work when fixtures are large or complicated, can best be done on heavy detail paper which will stand considerable erasure or on a good quality of bond paper. The majority of small jigs and fixtures can be laid out on bond paper of such a quality that blueprints can be made readily from it, if the drawings are well made in pencil.

Custom varies as to the amount of work which the layout man does, and his ability has something to do with the matter also. One man may complete his layout, place numbers on the various components, and list the parts completely before he turns it over to the detailer. We do not believe that this is the best way to obtain maximum production in the tool drafting department, as a good detailer can take an assembly drawing which is clearly made, and finish it up without great loss of time. It is necessary for the layout man to go over the drawing with the detailer and explain it to him thoroughly, so that there is no doubt as to the operation or details of construction.

The method of titling and numbering tool drawings is much the same in all tool designing departments, and we give in Fig. 587 a portion of an assembly drawing for a drill jig in order to illustrate clearly the general form. The sizes of sheets are designated by letters as follows:

A— 9x12 in., *B*—12x18 in.,
C—18x24 in., *D*—24x36 in.,
E—36 in. x any length.

Of course, other letters can be used and other sizes also if desired, but it is a very good plan to use sheets approximately the sizes mentioned because they are standard and can be obtained readily. The writers believe in placing the drawing number at the lower right-hand corner of the drawing and also at the upper left-hand corner. The letters and figures should be of good size and very plain as to style. If the letters and figures are placed up-side-down as shown at *A*, the number can be plainly read in the shop if the workman who is making the jig has the drawing up-side-down, as he frequently does. The title box, the position of which is indicated by the arrows *B*, can be printed on each sheet along with the border line, and the sheets can be purchased cut to size, if desired. If drawings are made in small quantities only, a rubber stamp can be made for the title portion and the required sheets cut from the roll of paper when needed.

Jig or Fixture Assembly Drawings

In making an assembly drawing of a jig or fixture, it is customary for the layout man to make at least two views, and oftentimes three are required. From these three views, the detailers must pick out the various parts and draw them to scale on another sheet of paper. All of the components which go to make up the jig or fixture must be numbered on the assembly drawing and listed over the title, as shown in the illustration. In order to avoid complication, we have shown the method of numbering the parts of an assembly drawing in a separate illustration.

CARN MANUFACTURING CO.,
653 Chestnut Street,
Milwaukee, Wis.

JOB NO.	DATE	KIND OF WORK
651	8-22-21	Transmission cases
790	4-6-22	Screw machine work
842	9-12-22	Spur and bevel gears

A

Job. #790 Carn Mfg. Co., Milwaukee, Wis.

Quantity ordered- 5000 of each of following parts:-
T-743 - Front hub.
T-744 - Front hub flange.
T-746 - Front hub cap.
T-747 - Retaining collar.
Patterns and castings to be made by us. Also jigs, fixtures and gages.

Deliveries to start not later than 6-15-22, and to be completed 9-30-22

Jigs, fixtures and gages must be ready 6-1-22.

B

Fig. 586—Card index for jobs

In Fig. 588 is shown at *A* an outline of a simple jig with a piece of work dotted in to show its general position. Each part of the jig is given a number, and each of these numbers is located in a circle from which an arrow extends to the particular part to which the number applies. This method is in general use in all tool designing departments, and the writers do not know

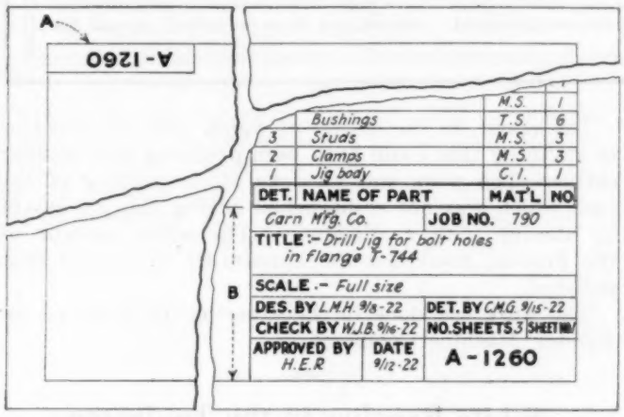

A
A-1260
B
M.S. 1
Bushings T.S. 6
3 Studs M.S. 3
2 Clamps M.S. 3
1 Jig body C.I. 1
DET. NAME OF PART MAT'L NO.
Carn Mfg. Co. JOB NO. 790
TITLE :- Drill jig for bolt holes in flange T-744
SCALE :- Full size
DES. BY L.M.H. 9/8-22 DET. BY C.M.G. 9/15-22
CHECK BY W.J.B. 9/16-22 NO. SHEETS 3 SHEET NO.
APPROVED BY H.E.R DATE 9/12-22
A-1260

Fig. 587—Method of titling and numbering tool drawings

of any better way than this, if care is taken in the placing of the circles and in the positions of the arrows.

In detailing, the same numbers are used, as shown at *B*. Adjacent to the number the name of the piece is given, the number wanted, the material of which it is composed and the treatment. Each detail should be complete in itself and should contain all the infor-

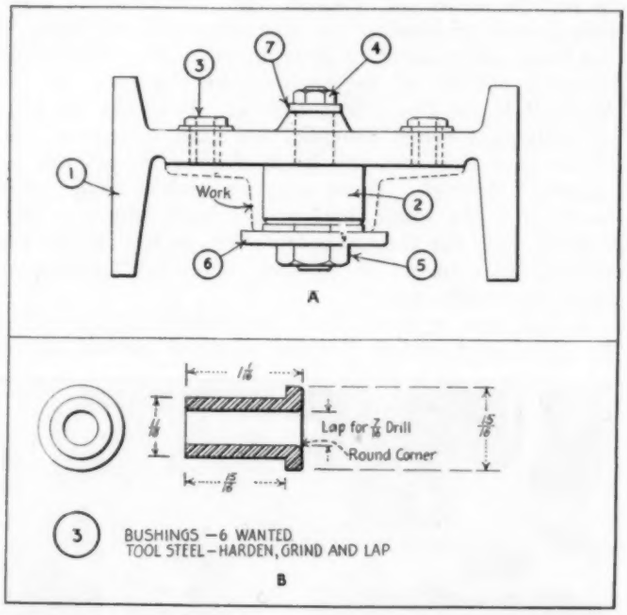


Fig. 588—Diagrams showing method of numbering and detailing jig drawings

mation necessary to make it up, so that it will fit properly in the fixture or jig when completed. Also each detail should have over-all dimensions carefully given, not only for the toolmaker's use but also as an aid in ordering the stock of which it is composed.

Motor Shop Problems

Piston Pins and Pin Bushings

By Frank C. Hudson

OF COURSE, everybody is building the best motor and all the details have been carefully studied. But all the same there's a lot of gray matter being mussed up, or otherwise exercised, over the methods of finishing the bearing for the piston pin, whether it is in the connecting rod or in the piston bosses. The problem of making the piston pins themselves has been pretty thoroughly licked in most shops. And whether rough ground between centers or on a centerless grinder, the centerless has at present come to be the machine for finish grinding in most cases, with some lapping process as the final operation. But fashions change in grinding as in bonnets, and next year may tell a different story.

There are those who claim to take a pin that is out of round and true it up on a centerless grinder. But a lot of others prefer to have the pin as round as possible before it goes to the centerless—which makes a beautiful job in such cases. And the time is little short of marvelous. In one high-grade motor shop, the pin is both rough and finish ground on the centerless, with five passes for roughing and three for finishing. The whole eight passes are made so as to give 1,500 finished pins in a 9-hr. day. Some reverse the pin at each pass and feel that it gives a little better result.

How About the Holes?

Getting back to the holes, we find a variety of practices. As one production man put it, "we get a pin that is almost absolutely perfect and put it in a bearing that has reamer scratches or worse." The question is how to get that bearing as perfect as the pin.

With the bearing in the aluminum alloy piston it does not seem difficult to get a very good reamed hole. But the expansion of the piston under heat makes it necessary to have a rather tight fit at ordinary room temperature to prevent too much freedom at working temperatures. In any case the bearing surface wants to be as smooth as possible.

Bronze bushings in the connecting rods are sometimes broached, the final finish being by burnishing buttons or rings behind the cutting teeth. The exact size is never easy to predict and this does not seem to be a favorite method at present. Reamers are not always satisfactory as bronze has a tendency to crowd away from the cutting edges and to crowd back again.

Some are grinding the hole in the bushing with very good results. Others grind to insure a round hole, and then finish with a reamer, which removes a very small amount of metal and, in reality, only smooths up the hole. This is not usually as rapid a method as desired.

At present several motor builders are finishing with a single point boring tool in which the cutting tool is a diamond. The practice is not new, as Marmon, and possibly others, have done a lot of experimenting along this line. But the idea seems to be growing in actual use while in still other instances it is being considered very seriously. The principal drawback seems to be in a lack of knowledge as to the peculiarities and habits of the diamond as a cutting tool.

Ideas from Practical Men

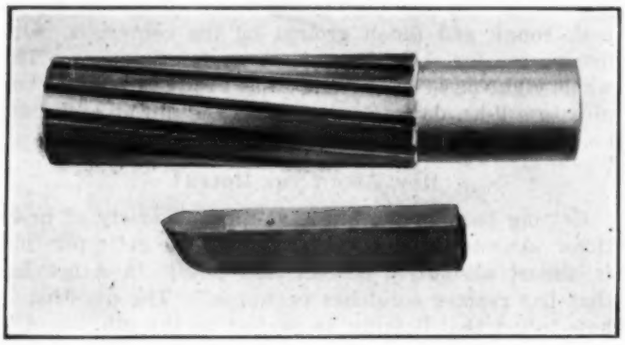
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Milling Machine Job Done in a Lathe

BY JACK WILLIAMS

The piece shown in the accompanying illustration looks like a job from a milling machine fitted with dividing head, change gears and other necessary attachments—but it isn't; it was finished, complete, in a toolroom lathe, the fluting being done with the tool to be seen lying before it.

The machine was a standard Hendey 14-in. toolroom lathe. The special attachments consisted only of two standard Hendey sub-headstocks, placed tandem on the lathe bed and each providing a speed reduction ratio of



Helical flutes cut on a toolroom lathe

6 to 1; thus rotating the work one turn for every thirty-six revolutions of the lathe spindle. The piece is 1¾ in. in diameter, the lead of helix 54 in. to one turn and the number of starts twelve. The fluted part is 6 in. long.

No special gearing was needed. The levers of the gear-box were set to indicate a lead of 1½ in. and the flutes were cut as if they were ordinary threads. The tool rested upon one side, which was ground complementary to the helix angle, with its cutting edge facing the headstock. As each pass over a lead was completed the locknut would be opened, the carriage traversed to the starting point by hand and the nut locked in in time for the second succeeding lead. With the work revolving so slowly there was no possibility of the operator making a mistake as to the point of locking in.

No attempt was made to produce the piece in record time, but the time consumed was not more than would have been required to flute the same piece in the ordinary way. The special tool was far less expensive to make than a special milling cutter would have been and no calculating of gears, setting of dividing sectors or other "setting-up" was required, other than swinging the two sub-headstocks into place; and that is about as much trouble as putting on a face-plate.

The result, in the matter of finish, was far superior to anything that could have been produced by a milling cutter. The work was all done at one setting of the tool, which was not resharpened during the job except by stoning with a slip-stone. The whole contour of the grooves presented the appearance of having been polished.

The work was done in the experimental room of the Hendey Machine Company.

White Benches in the Toolroom

BY CHESTER H. FRANKLIN

White paint is a great reflector of light and is being used more and more in shop interiors. Occasionally we find machine tools painted white, but as a rule, the custom does not last many years. It is extremely difficult to prevent the paint or enamel from turning yellow, owing to the oil which inevitably flows over it from time to time.

White paint on the toolroom benches is not open to the same objection, as there is less opportunity for it to become soiled or stained, and the reflected light aids greatly in reading fine measurements, and inspecting tools and measuring instruments. The illustration shows a portion of the toolroom in the plant of the Maxwell Motor Car Corp., Detroit. It shows the type of individual bench provided for each toolmaker, the swivel-base vise and the large drawer, which can be locked if desired. There are two shelves under each bench, and the small shelf at the back affords a convenient place for the toolmaker's kit, as well as for the pigeon holes in which to keep blueprints, orders or other necessary article.

It will also be noted that floor boards are provided for those who prefer to stand on wood instead of the

White Individual Benches for the toolmaker

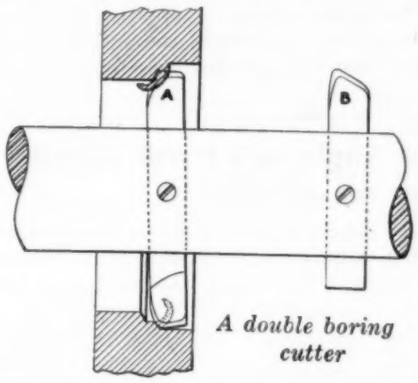
concrete floor. The equipment helps to make a most attractive tool room, and has its effect in securing the best grade of toolmakers available. This seems to be a place where white paint has many advantages and but few drawbacks. The cost is negligible in comparison to the possible increase in production.

Double-End Cutter for Boring Bar

BY CHARLES D. FOLSOM, JR.

The accompanying drawing shows a good way of grinding and setting boring tools so that considerable metal may be removed quickly with one roughing cut; leaving a hole accurate enough to be finished both smooth and true by a single, light, finish cut.

The particular job from which this suggestion is taken was the boring of one end of the connecting-rod of a steam engine. The rods came in lots ranging from 50 to 100 or more. They were of steel castings and had about $\frac{3}{8}$ in. and sometimes $\frac{1}{2}$ in. of metal to be removed from the diameter. The work was done in an old milling machine with a boring bar fastened in the chuck and supporting at the outer end in a bushing.



A double boring cutter

It is obvious that if the roughing tool were made to cut on only one end it would be likely to leave a hole considerably out-of-round and off center, owing to irregularities in the casting and "give" in the bar. But the usual form of double boring cutter is too difficult to make and set up for a short-run job like this, and so the form shown here, made from an ordinary tool-bit, was devised.

One end of the tool, shown upside-down at *A*, cuts first, and removes about half of the total roughing cut. The other end follows and takes off the remaining half of the cut. It does not make any difference whether the lead of one end over the other is a few thousandths or an eighth of an inch, so long as there is some lead. Nor does it make much difference if one end takes off a little more than the other; but for best results the two ends should remove about the same amount of metal so that the cutting pressures will be neutralized.

The over-all length of the tool *A* should be less than the rough bored diameter of the hole by one-half the amount of stock to be removed. Thus, if the hole is to be rough bored to approximately 2 in., and the cast diameter is $1\frac{5}{8}$ in., there is $\frac{3}{8}$ in. to come off the diameter. Half of this, or $\frac{3}{16}$ in., subtracted from 2 in. gives $1\frac{13}{16}$ in. as the length of the tool.

Both ends of the tool should be ground nearly square, so that it may be resharpened repeatedly without shortening it very much. It is well to leave it a little longer than necessary in the beginning, if there are many pieces to be done, so that it will allow of more regrinding before it becomes too short.

The tool should be set to leave $\frac{1}{16}$ in. or so for the finishing tool *B*, which is placed a few inches further along the bar.

Generating a Conical Spiral in a Lathe—Discussion

BY JORAN KYN

Under the title given above, on page 183, Vol. 60, of the *American Machinist*, Jack Williams tells how an apparently difficult piece of work was done in a very simple manner. I say apparently difficult advisedly, because such pieces were made by the hundreds of thousands before Hendey lathes were thought of.

Just how the pieces were made I do not know, but the fact that they were made in very large quantities, and before the days of special machines, is some assurance that their production was not difficult.

If anyone will take the trouble to examine an English watch made about 1880 or before, he will find that the spring barrel is connected to a grooved conical spiral cone by a chain, the purpose of the arrangement being to compensate for the gradual weakening of the spring as the watch runs down.

When the watch ran down, the chain would be nearly all wound around the spring barrel and would lead to the largest part of the spiral cone, or fusee, as it was called. In winding the watch, the chain would be wound on the fusee, pulling the spring barrel around and winding up the spring. When the watch was fully wound the chain would lead from the spring barrel to the smallest part of the fusee.

The compensating effect is due to the fact that, when the spring is coiled up and its force upon the barrel the greatest, the chain is acting on the smaller diameter of the fusee and its leverage upon the fusee is least; but as the force of the spring diminishes, the chain having reached larger diameters of the fusee, the leverage is increased, so that the action of the spring, modified by the changes in leverage, produces a uniform stress upon the fusee.

The fusee was used upon watches made early in the sixteenth century, and continued in use in England until toward the close of the nineteenth century, although it had been discarded by American watchmakers some years before. At first, catgut was used to connect the fusee and spring barrel, but later the chain was substituted.

How the watchmakers of old times produced fusees or conical spirals (I suggest a better name would be volutes) would be interesting.

Babbitting Cast Iron

BY I. B. RICH

One of my friends has been having trouble in making babbitt metal stick to cast iron in some special motor bearings in his shops. He called in an old time mechanic, who had seen a lot of odd jobs done in various parts of the world, and asked his advice.

After looking the bearings over, he said, "Tin them first, and the babbitt will stick."

"But how can I tin them when the tin will not stick any better than the babbitt?"

"Fix it so it will stick. Either copper plate the surface, or hold it against a brass wire brush until enough of the brass wears off to fill the pores of the cast iron, and make a brass surface. The tin will stick to this just as it does to brass or copper. After tinning you will have no trouble in making babbitt stick."

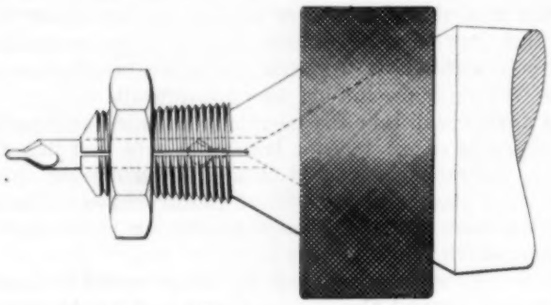
This is a thing which ought to be passed along, as it should be useful in many shops.

A Time-Saver for Making Center Holes

By Charles D. Folsom, Jr.

A handy little device, for the machinist's kit or for the lathe department in general is shown in the accompanying sketch. It is a small chuck for a center-drill, made so that it can be used in the lathe by simply holding it back against the tail center with the fingers.

The tool is made from a piece of bar stock held in the chuck with the large end out. It should be knurled,



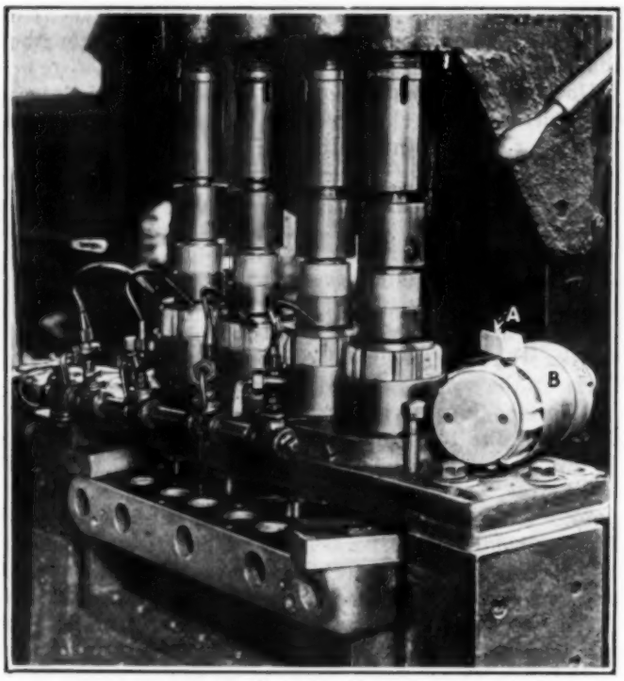
Finger chuck for center drills

drilled, bored, reamed, turned and cut off. Then the small end should be split with a hacksaw to about midway of its length. A small piece of stock about fifteen or twenty thousandths larger than the center-drill may now be forced into the hole at the outer end and the thread cut with a die adjusted oversize. This produces a taper thread, which after several trials may be made so that a few turns of the nut will squeeze the split parts together, and tighten the chuck on the drill.

Honing the Maxwell Cylinders

By Chester H. Franklin

The cylinders of the Maxwell motor are finished by honing in the machine illustrated herewith, which has been fitted up especially for this work. The hones



Maxwell cylinder honing device

themselves are 3 in. long, are made of No. 180 carborundum and molded in the shape shown at *A*. There are two hones in each slot. In this way, each hone presents two narrow cutting edges to the cylinder bore, or twenty cutting surfaces in all, as there are ten blocks in each head.

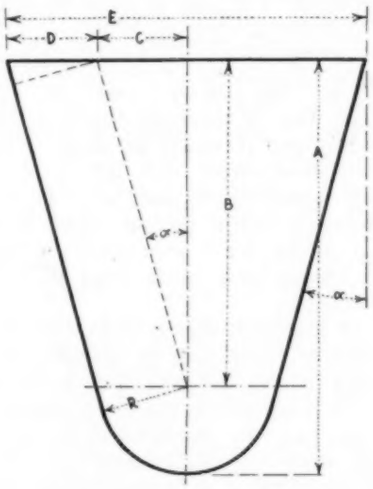
The head which holds the hone is made of aluminum, and behind each hone are three light springs holding it against the bore of the cylinder. The spindles carrying the hones revolve and also travel lengthwise through the cylinder bores. The cylinders are kept flooded with kerosene during the honing operation, which lasts about half a minute. The result is a very smooth finish and one that has proved very satisfactory in connection with the use of aluminum alloy pistons. Each honing head has five slots and a sleeve which keeps the ten hones in place until they enter the cylinder bore. One of these sleeves is shown at *B*, where it is covering the upper ends of the lower hones, and the lower ends of the upper hones.

As the hones enter the cylinders, the sleeves are pushed upward and are left resting on top of the cylinder block.

Checking the Angle on a Form Punch

By Edward Heller

In making a form punch of the shape shown in the accompanying sketch, where the radius *R*, the overall height *A* and the angle α are given, the angle can be



Section of form punch

checked very easily by measuring the dimension *E*. But, this dimension must be found first. The following method can be used to solve for *E*.

$B = A - R$

$C = B \tan \alpha$

$D = \dfrac{R}{\cos \alpha}$

$E = 2\ (C + D)$

The case that the writer had to deal with recently was a punch where *R* was $\frac{3}{4}$ in., *A* was $3\frac{1}{2}$ in. and α was 14 degrees.

Then, $B = 3\frac{1}{2} - \frac{3}{4} = 2\frac{3}{4}$ in.

$C = 2\frac{3}{4} \times 0.24933 = 0.6856$ in.

$D = \dfrac{0.97030}{\frac{3}{4}} = 0.773$ in.

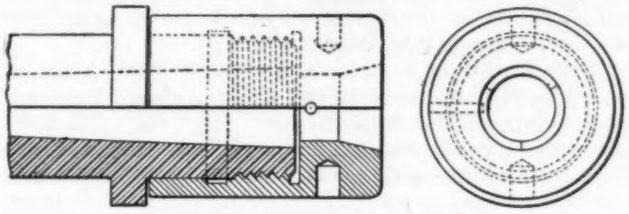
$E = 2\ (0.6856 + 0.773) = 2.9172$ in.

Fitting a Lathe with Draw-In Collets

By James McCall

Upon reading the article by Osgood Hickling on page 118, Vol. 60, of the *American Machinist* describing how he converted a "push" to a "pull" collet, I am reminded of a collet attachment that I made for some small Seneca Falls lathes.

An extension was made to screw on the spindle nose of the lathe, which it fitted very closely and accurately.



Nosepiece for draw-in collets

The thread, alone, was left a free running fit, but the bore was purposely made tight enough to wring on and radial holes were drilled in the body to allow the use of a "tommy" bar for placing and removing it.

The extension was made of machine steel, carbonized and hardened, after which it was ground to size in the bore and on the end where it was to abut against the shoulder of the lathe spindle. It was then wrung on the spindle, and the front bore, including the angular seat for the collets, ground to size and shape in position.

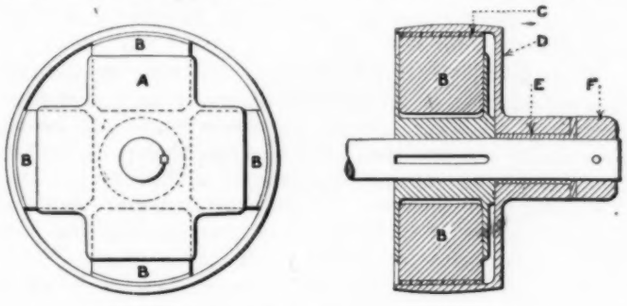
A draw tube of suitable length was made, also the requisite number of collets. The collets were made of tool steel and left soft. Three complete sets were made to cover the requirements of about a dozen lathes and were kept in the tool crib to be issued as needed.

The sketch shows how the body was made.

A Troublesome Drive and Its Remedy—Discussion

By Alfred H. Jones
Barrow-in-Furness, England

Referring to the article by John Williams, on page 690, Vol. 59, of the *American Machinist*, under the title given above, it is easy to imagine the difficulties which may arise in such circumstances. However, the trouble



A clutch designed to slip under excess load

is one which often besets the designer in other forms of machinery.

The solution illustrated in Mr. Williams' article, while evidently satisfactory, does not appear to be particularly cheap. I beg to suggest that a cheaper and more workmanlike result could have been obtained by the use of a centrifugal clutch. For anyone not acquainted with this device, the sketch herewith may be of service.

The spider *A* is keyed to the motor shaft or to an extension. The blocks *B* are machined to slide freely in the pockets of the spider and are faced at *C* with friction fabric. The belt pulley *D* is bushed, as at *E*, and is free to revolve upon the motor shaft. A collar, *F*, is pinned to the shaft to hold the pulley in place.

When the motor is started, the blocks *B* are thrown into frictional contact with the pulley *D* so that the load is gradually taken up as the motor comes up to speed. Should any obstruction be encountered, the clutch will slip.

In designing the clutch, the blocks *B* should be made rather heavier than the weight calculated, and afterwards drilled to the correct weight for balance, and to slip at the required load; say 10 per cent above the normal. Alternatively, the blocks may be cast hollow and loaded with lead to meet the requirements.

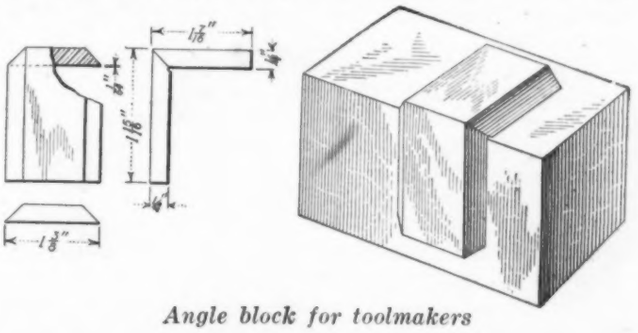
The secret of successful operation, as with all friction clutches is to keep the pressure per unit of fabric area as low as possible.

A Useful Tool for the Toolmaker

By A. B. Wells

A simple and very useful addition to a toolmaker's equipment is shown in the accompanying sketch, consisting of a small right angle block accurately made, hardened and ground.

The angle block is shown on a rectangular piece of steel, and, as may readily be seen, a line can be scribed



Angle block for toolmakers

on two adjoining sides of the piece of steel without changing the position of the angle block, thereby insuring extreme accuracy in matching the lines.

Dimensions are given for proportional purpose only, as the block may be made of any desired size.

An Expanding Arbor for Milling Cutters—Discussion

By C. Sackett

Referring to the article by Milton Wright, under the title given above, and published on page 374, Vol. 60, of the *American Machinist*, tapping the hole in the arbor and threading the end of the plug is not necessary.

A plain tapered plug, having an included angle of less than 10 deg., and provided with a screw-driver slot, is all that is necessary. Such a plug, coated with oil, and driven in will hold the cutter without danger.

To remove the plug, it is only necessary to use a stout screw-driver in connection with a monkey wrench, and turn to the left.

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Interesting Boys in the Machine Industry

FROM MANY different branches of the machine industry comes the complaint that boys do not seem anxious or even willing to learn the shop trades and that it is becoming increasingly difficult to recruit the force of real mechanics. Many reasons are advanced, from the extreme subdivision of labor to the pure cussedness of the rising generation.

Whatever the reason, the fact remains that it is not easy to get boys of the right caliber into the machine shop. The high wages of the building trades lure some, the dignity (?) of the white collar job entices others, or their parents, and there are plenty of other attractions unless a boy has strong mechanical tendencies.

It is high time that shop executives made a careful analysis of the whole situation. Let them put aside any preconceived notions as to what boys ought to do, and instead study what is actually happening—and why. Let executives ask themselves if the boy receives enough attention after he gets into the shop. Is he made to realize the necessity for good mechanics? Does the graduate apprentice have sufficient opportunities presented to make his four years of training seem worthwhile?

In too many cases an operator, with a few weeks training on a production job, can earn more money than a good mechanic who can be depended on for all-around work. Occasionally an exceptional man of this kind draws more than the foreman, who has all the responsibilities of the department.

The boy frequently hears glowing accounts of possibilities of advancement which do not materialize and it not only discourages him but others. A little more care in planning work, or shop organization, to afford real interest and inducement for the graduate apprentice would help, not only in keeping the bright young mechanic contented but also in adding to the number of recruits that come to the door asking for the opportunity to become real mechanics.

Paleontology and Machinery

ON FIRST thought there seems to be little in common between the study of the forms of life that existed millions of years ago and the recent developments of man's ingenuity. Nevertheless, machinery and mechanical devices are indispensable to the scientists who make this field their life work.

We have just had the pleasure of hearing Mr. Roy Chapman Andrews of the American Museum of Natural History tell of his discoveries in Mongolia. The dinosaur eggs found by his party were really a minor event in a trip crowded with important scientific discoveries but they have caught the popular fancy and have received the widest publicity. We came away from Mr. Andrews' lecture, in which he talked casually of animals that lived ten and twelve million years ago, feeling uncomfortably insignificant. The span of history of the human race is so trivially short compared to the duration of geologic periods.

A little contemplation of things as they are, and were, is somewhat more encouraging. Man has only been around here a short time but he has done quite a lot in that time. Taking account only of his material achievements as illustrated in the Andrews expedition we have some rather startling things.

With the aid of compass and theodolite the Andrews party was able to traverse and map the almost unknown rock waste of the Gobi Desert. And they did it in American automobiles and motor trucks. They recorded their discoveries with camera and notebook and timed the fastest moving animals known by racing with them. Motion pictures of gazelles moving at 60 miles an hour taken from a car traveling at practically the same speed are stimulating to the imagination if one stops to consider all that is involved in such a feat.

The prehistoric beasts of early geologic times even though they were fifty feet long and weighed tons, are not more wonderful than many of the commonplace machines of modern life. And they are gone—millions of years ago. We are here now, with many big jobs ahead of us. Where will we, or our descendants, be ten million years hence? What kinds of machines will the archæologist of that far distant future day use to help him in finding out what we, his remote ancestors, did to justify our existence? What means of transportation, of communication, of recording his discoveries will he use? Probably they will be so wonderful that we can have hardly the faintest conception of them or their possibilities.

Should Import Combinations Be Legalized?

WHAT IS to be done about securing raw material from sources outside of our own territory at reasonable prices? It is true that we can supply most of the raw materials we need for manufacturing purposes but there are some that have to be obtained abroad. Sisal and potash, nitrates and iodine, crude rubber and gutta percha, quinine, tin and mercury all come from other countries and are controlled by strong private and state combinations.

A recent letter from Secretary Hoover to Senator Capper reports on investigations made by the Department of Commerce into the control of sources of supply of various commodities. It is evident that price control is in the hands of combinations of producers and that the American importer is practically helpless, unable as he is, because of our anti-trust laws, to combine with other purchasers to combat the sellers.

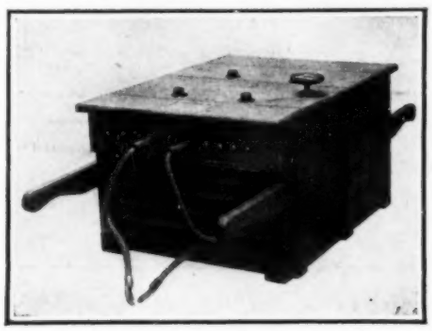
Mr. Hoover believes that some relief is possible, through legislation, from a situation that is costing American manufacturers and consumers hundreds of millions of dollars annually. The suggestion is made that such legislative relief might take the form of amendments to the Webb-Pomerene Act. The Secretary's letter closes with this statement, "The matter is one of urgent importance and should have early relief."

Shop Equipment News

"Electric" Universal Electric Welding Machine

The Electric Arc Cutting & Welding Co., 152 Jelliff Ave., Newark, N. J., is now marketing an electric welding machine of a universal type, so designed that practically any power supply can be made available for welding operations. This company has formerly built machines to operate on one or two voltages, and the universal machine is no larger than the earlier models.

The variations in voltage are met by varying the combinations of the coils of the primary winding, the 110-220-440-volt combination being obtained by multiple, series-multiple and series combinations of the coils. To make the same machine operate on 25 to 40 cycles, taps and adaptor windings are used to secure the proper electrical characteristics. The blower and the automatic switch also operate on all voltages.



"Electric" Universal Electric Welding Machine

In addition, the apparatus will operate on 110- and 220-volt direct current, using a resistor-reactor combination inserted in the secondary winding.

Special attention has been paid to the construction of the transformer, the core of which is silicate steel, the windings being double asbestos-covered magnet wire, adjacent layers separated by pure mica. The primary is separated from the secondary by four layers of mica and ¼-in. asbestos spacers. All wire joints are welded, asbestos tape is used, and there is nothing in the transformer to melt or char at working temperatures.

This apparatus can be used for nickel spotting, as well as all arc welding, and will also do lead burning, spot-tack welding, etc. The machine as shown in the accompanying illustration weighs about 200 lb. It is also furnished with handles and two wheels so that it can be moved about by one man, in wheel-barrow fashion.

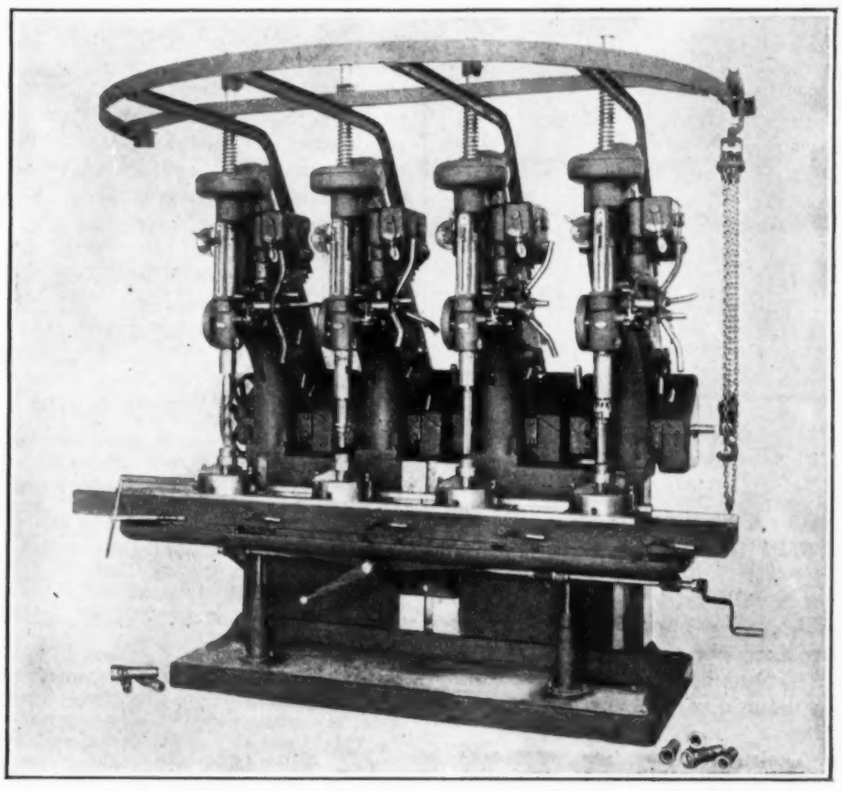
Jig-Handling Attachment for Barnes Gang Drill

A jig-handling attachment for use on its four-spindle, 24-in., self-oiling, gang drilling machine has recently been built by the Barnes Drill Co., 820 Chestnut St., Rockford, Ill., and is shown in the accompanying illustration. The apparatus consists of an overhead track with a trolley for returning the jig to the loading station, after the operations on a piece of work have been completed.

The machine illustrated is set up for facing, taper-boring and reaming cast-iron bushings 7¾ in. long. Four operations are required on these parts, the jigs being moved along the machine table for the successive operations. Upon the completion of the machining under the last spindle the work is removed from the jig which is then returned to the other end of the machine to receive the next piece.

The jig with the work weighs about 75 lb., the attachment being provided so that the jigs can be returned without being lifted by the operator. Since the four operations are in process at once four jigs are required.

A wire ball or handle is attached to each jig so that it can be quickly attached to the hook at the lower end



Jig-Handling Attachment for Barnes Gang Drill

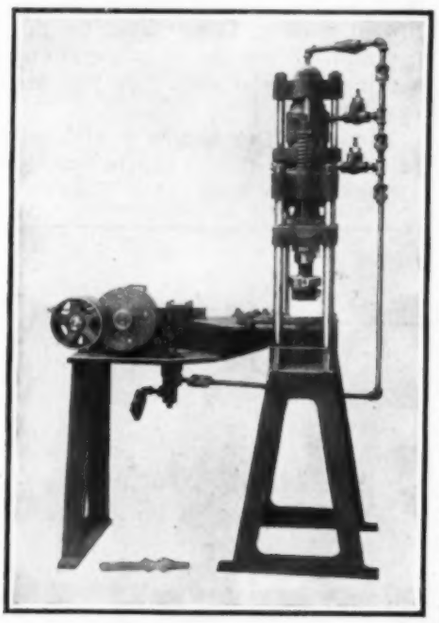
of the trolley hoist chain. It is stated that this attachment makes it possible to produce a finished bushing every 40 seconds with one operator.

The jigs are shown in operating position on the machine table in the accompanying illustration, the trolley and hoist hanging at the loading position.

Elmes Multi-Pressure Marking and Stamping Press

A hydraulic press to stamp names, trade marks, graduations, etc., on ball bearing races, machines parts or similar pieces, has recently been placed on the market by the Charles F. Elmes Engineering Co., Morgan & Fulton Sts., Chicago, Ill. Since the press is of the hydraulic type, it is possible to obtain uniform impressions, regardless of variations in the thickness of the work or the length of stroke of the marking die.

To provide for different pressure combinations, the press is equipped



Elmes Multi-Pressure Marking and Stamping Press

with three superimposed single-acting cylinders which can be used separately, or combined to provide seven different pressure combinations, when operated from a single pressure accumulator. Still further variations of power can be obtained by using a variable pressure accumulator.

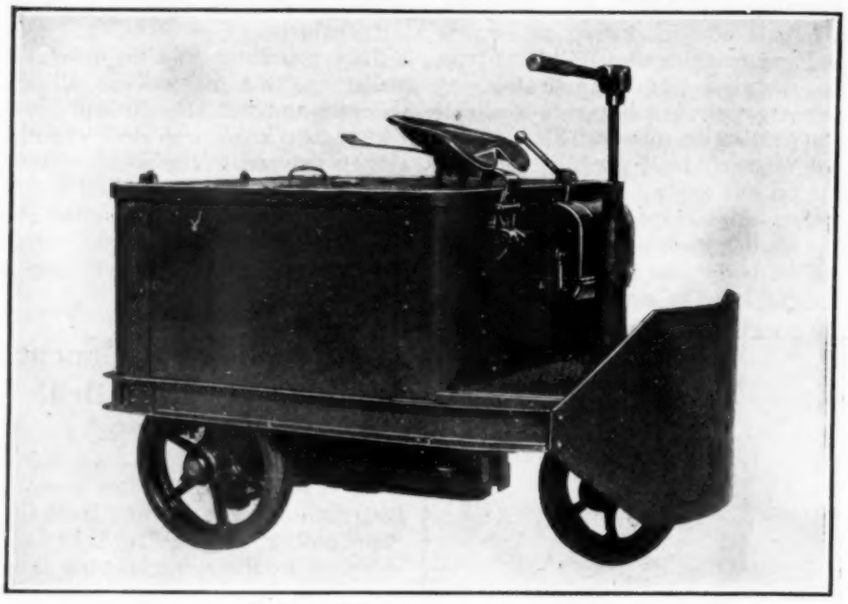
Hydraulic operation of the press is controlled by a special automatic valve. Feeding and ejecting of the pieces to be marked is also automatic and is arranged to feed the parts to be stamped from a hopper or feed tube, which is not shown in the illustration.

The press stroke and the feeding mechanism are arranged to accommodate pieces varying in shape and size and can be quickly adjusted for this purpose.

The press illustrated is designed for pressures ranging from 1½ tons to 20 tons, but can be built in any desired capacity.

Crescent Heavy Three-Wheel Tractor

A recent addition to the line of material-handling equipment manufactured by the Crescent Truck Co., Lebanon, Pa., consists of the three-wheel tractor shown in the accompanying illustration. This machine is considerably heavier than former models manufactured by this company and is built to stand up under exceptionally severe service.



Crescent Heavy Three-Wheel Tractor

The motor is of special design, built by the General Electric Co., and having a large over-load capacity. The drive incorporates a Brown-Lipe differential, driven through a worm and wormwheel. All castings are of steel and the frame is built up out of structural steel shapes, hot-riveted together to provide tight joints.

The driving axle is of chrome nickel steel, heat treated, and SKF ball bearings are used in the driving unit. Timken roller bearings are also provided in the drive. An oversize controller, made by the Cutler-Hammer Manufacturing Co., is furnished. The controller has ¾-in. fingers.

Spain Buys Many Autos

American automotive products have enjoyed an increasingly advantageous position in the Spanish market, since 1920, and it is probable that our automotive sales to that country for the current year will total approximately $5,000,000, according to Chas. H. Cunningham, former Commercial Attaché to Madrid, who is now in the United States.

"American cars find favor in Spain because of their adaptability and comparative cheapness. The more expensive American makes have benefited by this general increased demand and closed car models are making gratifying headway. Sales are also increasing in Portugal and plans are now being formulated for the construction of more and better highways in both countries which should lend a further impetus to this trade."

Fortunately, he says, there is no great hostility to trade with this country because of the indispensability of our cotton, tobacco, lumber, and petroleum products, but general exports from this country have received a considerable setback on account of the strong nationalistic tendencies which have been sweeping the country. Despite these sentiments, however, substantial gains have been made recently in our exports of machine tools, heavy electrical machinery, railroad equipment and accessories, and our agricultural implements and machinery trade with Spain is in a strong position.

News of the Week

Engineering Council and Czecho Society Will Hold Joint Congress

American delegates will visit Prague during July

American engineering societies will unite with the Czechoslovak Society of Engineers and Architects in an International Management Congress under the auspices of the Government of Czechoslovakia to be held in Prague in July, it is announced by the American Engineering Council. The Congress will follow the World Power Conference in London, which will be attended by engineers from practically every nation.

The Prague invitation was transmitted by the Masaryk Academy to the engineering societies of this country through the American Engineering Council, of which Ex-Governor James S. Hartness of Vermont is president. Acceptances have been received from the Four Founder Societies of Civil, Mining, Mechanical, and Electrical Engineers. Management problems in manufacturing and allied pursuits will be discussed.

The program embraces technique of organization and management, office organization, management control, labor relations, elimination of waste, cost accounting as a factor in production and control, and motion and time studies are also included in the list of subjects to be discussed.

American and Czechoslovak engineers will deliver addresses. Delegates will attend from Poland, Jugoslavia and Bulgaria and other central European countries. Dr. B. Stepanek of New York, former Minister from Czechoslovakia to the United States, and Stan Spacek, Engineer Attaché of the Czechoslovak Legation at Washington, are aiding in the arrangements for the Congress.

The Czechoslovak Government, it was said, has shown a keen interest in engineering development in the United States, and has translated as an official document for general distribution among the industries the report of the Hoover Committee on the Elimination of Waste in Industry. The Prague Congress, it is expected, will provide new opportunity to further international unity in the profession of engineering, toward which progress is being made, particularly in England, France, Italy and the United States.

Government Will Make Gage Appropriation

By approving an appropriation for $50,000 for the procurement of gages, dies and jigs for the Ordnance Department of the Army, the Committee on Appropriations of the House of Representatives has taken the necessary step to give this important phase of Ordnance manufacture a legislative standing. If the measure is retained in the War Department appropriation bill, throughout its legislative course, as seems practically certain, it will mean that this item will be continued from year to year which will make it possible to have gages planned for all the materials for which they are necessary, with drawings and specifications in finished form so that in the event of an emergency it will be possible to start without delay the gage makers of the country on their production.

The Ordnance Department has a considerable stock of gages left over from the war period. These have been classified and card indexed carefully and put away, properly greased, so that they may be used in time of necessity. General Williams, the Chief of Ordnance states, however, that many of the sets of gages are not complete. Many of them are almost worn out due to the fact that they could not be properly made in all instances because of the urge of war production. The great urgency at this time, however, is to provide gage designs for the new material, which it is necessary to provide.

Increases in Steel Production

Production of steel ingots, which increased sharply in January and the forepart of February, has increased slightly even in the last fortnight. The lowest rate last year was in December, when ingots were made at an annual rate of 35,400,000 tons. January showed a rate of 41,500,000 tons and February a rate of 47,000,000 tons. As production was increasing during February the rate at the end of the month was above 47,000,000 tons and with further increases since, the present rate may be estimated at about 49,000,000 tons. The highest rate hitherto recorded is a 49,000,000 ton rate, in April of last year.

Accordingly the record rate is reached earlier this year than last. This is remarkable for two reasons. First, the steel market did not appear to be altogether as active in December, January and February as it did in the months of a year earlier; second, it had been predicted that the three-shift system would involve a labor shortage.

The increase of 114,472 tons in the Steel corporation's unfilled obligations during February made a better showing than had been expected in some quarters. The January increase had been 353,000 tons, while buying had decreased and shipments increased. Shipments of rails and tin plates in February greatly exceeded the new bookings. In sheets and wire products there was approximately an even break. In tubular goods there was a gain in the order book, as there was in the heavy rolled products, bars, shapes and plates taken as a class.

Car Loading Record Broken

With 945,049 cars loaded for the week ended March 1, the railroads of the United States broke all records for corresponding weeks in previous years, the Car Service Division of the American Railway Association announced. This total exceeded by a wide margin the loading record for any week in January, February or March in history. Compared with a year ago, it was an increase of 26,425 cars, with the corresponding week in 1922, an increase of 151,934, and with the corresponding week in 1920, an increase of 133,943.

The week's total was 99,151 cars over the week immediately preceding, when loadings were reduced by the observance of Washington's Birthday. Except for live stock, increases compared with the week before were reported in the loadings of all commodities.

Lansing Factories Are All Busy

About 2,000 more workers are expected to be added to the factory pay rolls in Lansing within the next 90 days, according to figures announced by the manufacturers of that city. Most of the plants in Lansing are now operating at capacity.

The Olds Motor Works recently has added 2,000 men to its force and now has about 4,000 men employed, and expects to require another 1,000 workers by June.

The Fisher Body Corp. is to establish a plant in Lansing in April, where 600 men will be employed. The Reo Motor Car Co. is working with about 5,000 men, and is preparing to open the plant recently purchased from the Duplex Truck Co. The Motor Wheel Corp. is employing more men than ever before and this is true of the other factories in this section of Michigan.

Strikes Cost Billions, Says Fannon

"The greatest necessity in industry today is a clearer conception of the advantages of good will between employer and employee," said S. F. Fannon, of Boston, industrial relations expert, addressing the Industrial Relations Committee of the Philadelphia Chamber of Commerce.

"The actual cost to American industries for the lack of this good will, in the last few years, has been $3,000,000,000, due to strikes and various disturbances, caused by unrest among workers. This amount is equal to the total exports of the United States for the first eleven months of 1923. Because of the failure to obtain a sound basis of industrial relationship, the industrial dollar is worth only seventy-five cents.

"Philadelphia has gained an enviable reputation because of the fact that not one strike occurred here in the last year. Therefore the seventy-five-cent dollar does not hold good for Philadelphia. Employers are spending much money in research work to obtain the best possible raw material at the lowest figure, but few industries have paid much attention to the payroll investment. The ordinary payroll for three years should equal the total investment in plant and equipment."

Mr. Fannon told the committee that, with Europe gradually becoming more stabilized in her industries, America will not be able to compete with continental products "unless there is an industrial housecleaning here."

Wright Aero Reports Good Year

The Wright Aeronautical Corp. reports net sales of $2,226,891 and operating income of $254,836 for 1923. After crediting other income and allowing for taxes and adjustments the net income was $326,542. The profit and loss surplus on Dec. 31, 1923, was $1,205,488. The balance sheet showed current assets of $2,281,967 against current liabilities of $142,643. Current assets included cash of $388,358, marketable securities valued at $870,565 and inventories valued at $706,720.

F. B. Rentschler, president, in a statement to stockholders said in part:

"There has been no change in the status of the claim of the United States War Department against the Wright-Martin Aircraft Corp., growing out of the war-time cost-plus contracts of that corporation. Your counsel believe that there have been no overpayments made to the Wright-Martin Aircraft Corp. and that substantially the amount of $1,180,696.90 now withheld from payment is due your corporation from the Government.

"Except for the continued successful operation of the air mail by the Post Office Department, no particular progress has been made during the year in commercial aviation. Equipment for military service for both the army and the navy is rapidly improving and continuing to become of increasing importance as an element of national defense. The increased efficiency and durability of engines, which are the result of intensive military development, will become the direct heritage of commercial aviation. Not only in this country but abroad military aviation is steadily gaining in importance, and its use is becoming broader.

"On Jan. 1, 1924, your corporation had business on its books amounting to $2,094,135.80. Since that time it has received additional business amounting to $237,984. Inasmuch as this new business is for types of engines that may be said to be already in production in our shops, we look forward to rather better results for 1924 from this business than the results of 1923."

Power Show Advisory Committee

The increasing scope and importance of the National Exposition of Power and Mechanical Engineering is shown by the addition to the Advisory Committee of the presidents of the American Society of Heating and Ventilating Engineers and the American Society of Refrigerating Engineers. Homer Addams of New York is president of the A.S.H.V.E. and George A. Horne of New York is president of the A.S.R.E. The American Society of Mechanical Engineers, the National Electric Light Association and the National Association of Stationary Engineers are already represented on the Advisory Committee by their officers. The A.S.M.E. delegation consists of the President, Fred R. Low, the Chairman of the Professional Divisions Committee, James Partington, the Chairman of the Power Division, Nevin E. Funk, and the Secretary Calvin W. Rice.

The Third National Exposition of Power and Mechanical Engineering will be held in the Grand Central Palace Dec. 1 to 6. Eighty per cent of the exhibitors at the Second Exposition have contracted for space at the coming event.

Farmer Talks to A. S. S. T. Hartford Members

The March meeting of the Hartford chapter of the American Society for Steel Treating was held March 11 at the Hartford Engineers' Club Rooms. Malcolm Farmer, vice-president of the Stanley Works, New Britain, Conn., was the speaker of the evening and the subject discussed was "Cold Rolled Steel." The mechanical working and heat treatment of cold rolled steel was explained.

Bridgeport Machine Co. Report

Net earnings of the Bridgeport Machine Co. in February totaled $79,300, an annual rate of $951,000, compared with earnings for the entire year 1923 of about $250,000. The current improvement is attributed to the increased activities of oil companies to which the company sells drilling tools and equipment.

Germany May Admit American Autos

Germany, barred to American automotive products for years, may become again an open market within a few months, Trade Commissioner A. J. Gray informs the Department of Commerce. Agitation on the part of German motor car dealers point to an early lifting of import restrictions and a renewal of business in American cars and trucks.

The present situation in Germany involves three groups—manufacturers, dealers, and public. The manufacturers, who, it is said, wield a strong influence in the Foreign Trade Control Board, have opposed relaxation or abolition of the import restrictions on the ground that it will curtail sales of domestic cars and result in higher prices and extensive unemployment.

The dealers, who include about 2,000 different firms, believe that prohibition is harmful to all concerned. In shutting out American cars, the prices of which range from one-third to three-quarters of the German cars of corresponding types and sizes, numerous potential consumers of low priced cars are deprived of advantages arising from the use of motor cars they say. The dealers declare that the presence of these cars in Germany would promote commerce in general and would change the aspect of the automobile from that of a luxury, accessible only to a few, to that of a utility.

This is also said to be the attitude of the public, which holds with the dealers that the popularization of the automobile will have a general energizing effect on German industry and commerce.

In German trade circles it is the opinion that the position of the dealers and consumers is growing stronger and that in the near future the manufacturers' organization may give its assent to the raising of the prohibition, but not, it is believed, without first being assured of an upward revision of the tariff. The consummation of the first step has been predicted to occur between March 1 and May 1 of this year. The unrestricted admission of American cars would relieve the dealers in many ways, especially in view of the alleged difficulties they have had with the German manufacturers for the last four years in the matter of price increases and irregular deliveries of automobiles and trucks.

Willys Creditors Paid in Full

With the payment of a 10 per cent dividend to the creditors of the Willys Corp., Receiver Francis C. McCaffrey liquidated in full all the claims against that company. The last disbursement amounted to about $1,500,000.

One of the subsidiaries of the Willys Corp., the Duesenberg Motor Corp. is still in controversy with the Government over a claim of $1,500,000 growing out of war contracts. Should this claim be decided against the company, the Willys Corp. may be called upon to make the payment.

Notes of Washington Activities

By Paul Wooton

The Bureau of Engineering of the Navy is working first for safe machinery; second for reliable machinery; and third, for efficent machinery. This statement was made by Admiral Robison, the chief engineer of the Navy, by way of justification for the appropriations asked for the work of the Bureau of Engineering during the next fiscal year. The House committee allowed a total of $18,012,300 for the Bureau's expenses.

The alterations and improvements which this amount will cover deal with unsatisfactory, unreliable or unsafe operation of machinery afloat; with improvements or alterations to accomplish a specific purpose and with the general improvement which results from engineering progress. Examples were cited to the Committee by specialists of the Bureau to cover each of the foregoing types of work. It has been found necessary to make major alterations in the forced lubrication systems of battleships. It has been found that under certain conditions of list, these lubricating systems do not function. Were a ship to be torpedoed and have a list of ten or fifteen degrees, it has been found that the oil will not return to the tanks and that the pumps will not develop suction.

An improvement falling in the second class mentioned above is the need to provide smaller forced-draft blowers on ships for use when a ship is in port and at other times when the operation of the large blowers is not required. Destroyers have a large machinery plant. They vary from 28,000 to 30,000 hp. In port the steam consumption for a ship of this character is very small. To keep up steam to operate the large blowers resulted in the unnecessary use of a large amount of fuel. The fuel-testing plant at Philadelphia now has developed a small auxiliary blower driven by a turbine which results in a very large saving in fuel-oil.

An example of expenditures made necessary by engineering development is the availability at this time of better evaporators. Great economies can be effected, the committee was told, by replacing the evaporators on capital ships with those of the new type. On a battleship, the new type of evaporator will save $50,000, it is estimated.

MACHINISTS IN THE NAVY

By inducing efficient machinists to enlist in the Navy, and through the service trades schools, where they are trained, 80 per cent of the repair work on vessels is done by the ship's own personnel. This results in great economies. By having repair work done on the ship by the ship's regular enlisted personnel, supervised by the ship's own officers, a saving of 75 per cent often is made, Admiral Robison testified, as compared with the charge which would have resulted had the work been done at a Navy yard.

Now that the Bureau of Standards is to have a direct appropriation for work on automobile power plants, it will be able to carry forward an increased amount of research in that connection. Considerable work has been done on these problems, but with funds furnished by the War Department or outside agencies. In this work, the Bureau carefully avoids the problems which could be classed as competitive research between automobile manufacturers. The Bureau's research will be confined to those fundamental problems which apply alike to all makes of engines and from which the users of automobiles may benefit.

Bock Bearings Company Is Re-organized

Plans for the re-organization of the Bock Bearings Co. of Toledo were completed in Cleveland recently when a number of prominent Cleveland and Ohio business men went on the board.

Maynard H. Murch of the Maynard H. Murch Co., investment security dealer, was elected president, although Robert E. Clingan, vice-president and general manager, will continue as the operating head of the company. C. O. Steinbicker was elected secretary and treasurer.

The directorate was increased to nine through the election of the following members: W. E. Bock, president of the Erie Glass Co., and the Bock Laundry Machine Co., Toledo; W. S. Quinlan, president of the Chicago Nut Manufacturing Co.; W. G. Mather, president of the Cleveland-Cliffs Iron Co.; F. F. Prentiss, vice-president of the Cleveland Twist Drill Co.; John A. Kling, chairman of the Kelly Island Lime & Transport Co. and president of the Cleveland Builders Supply & Brick Co.; George E. Randles, president of the Foote Burt Co.; R. B. Wallace of the Kinney Steamship Co., Cleveland, who with Mr. Murch and Mr. Clingan complete the board.

An executive committee consisting of R. E. Clingan, George E. Randles and W. S. Quinlan was also appointed.

Railroad Lists in Chicago

The Southern Pacific Ry. has placed an order for one car box bore. The Chesapeake & Ohio Ry. is inquiring for a number of engine lathes. The Chicago & Western Indiana R.R. has ordered a 5-ton hand power pillar crane from the Whiting Corp., Harvey, Ill. The Great Northern Ry. is inquiring for one 30-ton standard gage eight-wheel locomotive crane for use at St. Paul, Minn. The New York Central has placed an order for a 30-in.x10-ft. planer. The Pennsylvania Ry. has placed an order for a 42-in. boring mill, 24-in. shaper, 36-in. lathe and a 36-in. crank planer.

The Canadian Pacific Ry. is planning to extend its Ogden car shops and its engine houses at Outlook and Wyneard. The Florida East Coast Ry. is reported to have selected a site at Bowden, Fla., for the erection of new locomotive repair shops to replace the present shops at Jacksonville, Fla. The Chesapeake & Ohio Ry. is planning to construct an extension to the roundhouse, a new erecting shop, an extension to the locomotive shop, two new machine shops, a new boiler shop, a passenger car shop and a truck shop at Huntington, W. Va. The International-Great Northern Ry. plans the construction of a roundhouse at San Antonio, Tex., at an estimated cost of $100,000. These extensions and additions will necessitate the purchase of machinery and tools.

Will Test Gage Steel for Durability

Service tests of steels to be used in making gages are to be begun in the near future, according to a decision arrived at at a meeting of the Gage Steel Committee held recently at the Bureau of Standards, of the Department of Commerce. The Secretary of the Committee was directed to seek the co-operation of the automotive industries in this project. It is believed the tests can be made rapidly with their help, as automobile manufacturers are extensive and heavy users of gages.

Sixteen members were present at the meeting, representing gage makers, steel makers, the Army and Navy Ordnance Departments, the technical societies, and the Bureau of Standards. The completed work of the Committee was discussed and plans were made for the immediate determination of the effect of the more important variables involved in the wear of gages.

Gages are used in the manufacture of automobiles and other machines in which the parts are made interchangeable. Each part is tested with "go" and "not go" gages, one of which will cause its rejection if it is too big while the other tells if it is too small. A very high degree of accuracy is required in these gages, and it is also necessary that their dimensions change as little as possible with use or age.

Freight Car Buying Is Much Increased

February car orders were the largest for any one month in about four years, and since March 1 additional orders have been placed bringing total business from the beginning of February to date to between 63,000 and 70,000 cars.

Railroad specialty makers are equally optimistic. They report good and steady volume of buying. One of the larger of these companies has taken over a half year's capacity business in two months.

Among the larger car orders recently placed are 15,000 for New York Central, with 3,000 more optioned, 11,000 for Pennsylvania, 8,000 for Norfolk & Western and 5,500 for Atchison.

Larger locomotive orders include 169 for New York Central, 50 for Canadian National and 35 for Union Pacific. American Locomotive appears to have received the lion's share of this business.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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THIS is written from Duluth whither I have come after a brief visit to Chicago, Minneapolis and St. Paul, because I have wanted to personally acquaint myself with conditions in the Northwest. From the stories that have been printed in the Eastern papers I was prepared to find acute depression and great distress here. We have been told that banks were failing by the hundreds, that the farmers were deserting their farms, that the discontent was great, and that the political radicalism engendered by misfortune had so large a following that it would hold the balance of power at the next election and in the next Congress.

I find that these reports are gross exaggerations. In the ninth Federal Reserve district there have been about 600 bank suspensions in the last two years, but most of the banks that have been closed were very small and many of them will be nursed back to life with the aid of the emergency Agricultural Service Corp. that has a capital of $10,000,000 subscribed for this purpose. This corporation is already in the field and is doing good work.

More than half of the suspended banks are in Montana and there is no doubt that in that state and in the Dakotas the failure of the wheat crop has dispirited the farmers who suffer. But they are the exception rather than the rule, and in Minnesota and Wisconsin rural conditions are but slightly subnormal, while business in the cities is good and there is no unemployment observable anywhere.

The third party bogy also loses its terror upon close inspection. It is true that the Farmer Labor Party is arranging to hold a convention at St. Paul on June 17 when delegates from eight states are expected to be present, but there is doubt as to whether they will nominate condidates for the primary, and among the leaders there is already dissension as to whether the communists shall be accorded recognition. To the experienced student of American political history it seems entirely improbable that a party that divides against itself can become a political factor of any importance.

Meantime more of the farmers have sold their wheat and as the increase in the duty on foreign grown wheat ordered by President Coolidge has not advanced the market as it was expected to there is perhaps less faith in the other factitious remedies that have been urged including the McNary-Haugen bill of which surprisingly little is heard. Speculation in grain futures is in fact almost obsolescent and on the Chicago Board of Trade a petition for its temporary abandonment has been numerously signed, the purpose being to find out whether the next crop can be marketed without the customary hedging facilities. The entire absence of speculation in every line of trade throughout the West is indeed remarkable and unusual. There is no interest in the stock market, the Wall Street news attracts but little attention, the fall and rise in francs is not commented upon, merchants are carrying very small stocks and although the retail demand is good no one seems willing to take any avoidable risk with anticipating the future. As one experienced merchant said to me, people of this region are again learning that "early to bed and early to rise; work like hell and economize" is the best way to recover themselves and they are doing it.

The railroad business reflects this sensible disposition for while the freight traffic is holding up remarkably the passenger business is relatively small. One railroad office attributes the falling off in the passenger travel to three causes: the automobile, which is more convenient for short journeys; the long distance telephone, which makes many business trips unnecessary; and the radio, which diminishes the incentive to leave home for entertainment. But whatever the cause it is plain that fewer people are travelling and as to the radio it has undoubtedly come to be a very important factor in life here for with its wonderful assistance those who were hitherto isolated are now able to keep abreast of the world's affairs more easily than if they lived in Chicago or New York. They listen to sermons over the radio, they attend political meetings over the radio, they hear lectures and concerts over the radio, they get the market quotations over the radio and if and when it becomes possible for America and Europe to hear each other freely over the radio it may be that the international antagonisms which now exist will literally vanish into the air.

I will return to New York re-assured by the belief that conditions in this region are much better than I had been led to think and are likely to improve rapidly from now on. These are the views of nearly all the business men with whom I have talked. And as this is the only portion of the country in which anything like adversity is supposed to have been felt, the foregoing is submitted as more interesting and important than the customary reviews of the markets, which have been generally quiet and featureless.

What's Doing in Industry

Business in the machinery and machine tool lines were not as brisk during the past week as it has been heretofore this year. No alarm is occasioned by this, as it is explained in most sections of the country as being merely a lull following good business and preceding a resumption of activity.

Automobile production goes on at an unprecedented pace in the principal automobile manufacturing centers and the spring demand for cars is said to be larger than in any previous year.

Freight car buying and locomotive ordering has been featured lately by the railroads in all parts of the United States and Canada and it looks like a prosperous year for railroad car builders.

Freight car loadings have started again on a record-breaking career, the first week in March setting a new figure for loadings.

The demand for electrical goods keeps up and heavy electrical equipment found a good market during the opening weeks of March.

Business is generally good in all States and there is nothing disturbing in the offing.

The Anglo-American loan to France strengthened the belief that Europe would commence to untangle herself during this year. It is significant as illustrating the faith our big bankers have in the ability of France to stage a comeback. Settlement of the Memel and Corfu disputes and clearing of the way for a Hungarian loan at the meeting of the council of the League of Nations are also harbingers of better times abroad.

Philadelphia Foundrymen Hear Ryan

The Philadelphia Foundrymen's Association held a dinner and meeting on March 12 at the Manufacturers' Club in that city. F. J. Ryan, of F. J. Ryan & Co., was the principal speaker taking for his subject, "Annealing of Cast Iron." His speech was illustrated by slides and he explained the new methods that are now used in this process.

The Industrial Review

What the year has yielded and some predictions for next year's production

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Buffalo

Machine tool business in Buffalo still seems to be on the upgrade with no indications of a slackening, and a majority of the local offices report that March business thus far is running ahead of the February and January averages. One reason for this has been the breaking of the expected Pierce Arrow order for equipment to be used in building a lighter and less expensive type of car, a new model that will be put on the market some time during the year. Lists for this equipment have been out several months, but right up until the last week or two the company would not close. Now they are buying and chances are that by the end of March they will have closed for about all the equipment needed in the new shops. The bulk of their buying up to date has been drills.

American Radiator is reported to be buying some equipment for its so-called terminal plant, recently purchased from the U. S. Government. This plant will be largely equipped with used machinery moved from other plants of the company, it is said, but some new tools will be needed and orders for most of these will be placed locally. Curtiss Aeroplane & Motor Corp. is reported to be buying in limited quantities.

Local tool firms that have offices in Rochester and Syracuse differ as to conditions in those cities. Some report that business East of Buffalo has been dull, while others report March as the best month of the year. One firm reporting a satisfactory business in Rochester and Syracuse has been disposing of a large quantity of used equipment recently acquired and this may have been responsible for boosting the bulk of their sales even in a period of lessened buying.

There are some railroad lists out at the present time and quite an active competition has developed for the business. Punches and shears form the bulk of the railroad lists.

Chicago

Dealers in machinery and machine tools in the Chicago district report increased activity among small industrial concerns. A dealer in machine tools and machinery who probably has the largest store and showroom in the city reports a very material increase in inquiries from industrials and states that many of them have visited the store during the week. Several other dealers have noticed an increase in personal visits at their stores by prospective industrial customers. Most of the inquiries and visits are from small industrials that require single tools. Selling to industrials is a little more active, although delay and indecision on the part of buyers still exists. The industrial buyers seem to be unusually conservative and do a great deal of shopping for better prices before closing orders. Used equipment has not moved so well lately. The Santa Fe continues to send out inquiries and the list is so large that practically every dealer is anticipating a portion of this business when purchases commence some three weeks hence.

The Inland Steel Co., Chicago, is making inquiry for a 60-in. boring mill, several cranes and special machinery as well as a 36x36-in.x8-ft. planer, and a 30-in.x25-ft. engine lathe. The Illinois Steel Co. is inquiring for several machine tools. The Baltimore & Ohio R.R. is inquiring for six 15-ton locomotive cranes.

Most of the machine tool dealers in the Chicago district believe that industrial buying will gradually improve and it seems to be the general opinion that March sales will approximate those for February and April will be the banner month thus far this year. This opinion is based on the fact that inquiries from industrials are more numerous than sales, but consummation should take place in April.

Cincinnati

Production of machine tools in Cincinnati during the past month has not been as large as many manufacturers had anticipated. Orders which concerns had expected to be placed did not materialize and the volume of output was not satisfactory. Automobile manufacturers have been holding off in making their purchases and the lack of business from this source has cut deeply into the production of local machine tool houses. Cincinnati plants vary in their opinion as to whether or not there will be much buying by the automotive industry during March, the majority of them believing that purchases will continue to be conservative. Railroads also have been holding back in their plans for adding to their equipment and little business has been realized from the transportation lines by Cincinnati machine tool men in the past month.

Despite the fact that there is a quiet condition prevailing in the Cincinnati market at present, manufacturers in many cases state that they have had more inquiries in the past few weeks than during any other period in many months. They feel that many of these will result in good orders within a short time and this belief makes them optimistic about the outlook for the immediate future. A survey of local operations, however, shows that production is considerably behind that which had been hoped for at the beginning of the year.

Manufacturers of milling machines and lathes report that their orders have been fair. Several makers of planers are doing a nice business at the present time, while the production of upright and radial drills continues rather quiet. Electrical tool plants are operating on a satisfactory basis with present orders sufficient to insure a steady output for the next few weeks. Woodworking machinery production shows no let down, plants operating on a capacity schedule. Automobile accessory manufacturers state that their business has been good in the past month. Conveying machinery concerns are turning out a large volume of business. The metal trades continue quite active. Steel mills in this district are being operated practically on a capacity basis which is considered exceptional for March.

Cleveland

Machine tool producers and distributors in the Cleveland district have cause for more optimism since the beginning of March than they have had since the beginning of the year. By no means has the outlet for the heavier, or even the lighter, equipment improved to the point where it is even fair. It is merely better. This is a consensus of opinion based upon actual orders for shear, punch, automatic, planer, drilling, milling, lathe and the rest of the standard lines.

At the same time the inquiry end has shown better form than the actual order part of the business, indicating that general manufacturing is feeling its way and really looking ahead.

Planer and milling machine producers are more satisfactorily affected, in this connection, it seems, than most producers. In the last fortnight several good sized orders have been received from Canadian manufacturers for equipment for general purpose manufacturing. Likewise railways in Canada appear to be preparing for improvements to their own equipment, and from these quarters, too, substantial business is being booked.

That the automotive industry may be anticipating some competition and that certain manufacturers want to improve still more the appearance and efficiency of their own product, is indicated in the renewed interest for automatic equipment.

Locally, and in nearby districts, the manufacturing situation is not overbright. Practically no new moves have been made in any industry for weeks, and it is quite apparent that there is sufficient of the present equipment in these plants to permit them to turn out

all the product they have call for at this time.

While the building situation may have but a remote effect upon the machinery trade itself, it cannot be denied that the shear, punch and similar equipment is finding a more favorable outlet during the last few weeks.

New York

March has not proved as good a month as February for the machinery and machine tool dealers in the New York district, although there has been but little complaining by them regarding the business done so far this year. Most dealers prefer to view business quarterly rather than monthly as they claim that from the time an inquiry is received or the prospect located until the time the sale is actually consumnated is usually three months.

Automobile parts makers are buying machine tools and a few of the railroads are reported as purchasers during the past week. Most dealers are watching developments in the South and expect to be in a position to sell in that district from the New York offices within a short time. Business has been good there and dealers consider it worth further cultivation.

Textile machinery is being bought to quite an extent by the New England fabricators as well as some of those in the central South.

Machinery exports show gains during March and exporters are pushing their good luck to the limit.

Philadelphia

Expenditure of approximately $1,600,000 for new machinery, equipment and additional piers is in the program of the Philadelphia & Reading Railway Co., in the development of its ore handling equipment at Port Richmond, outside of Philadelphia.

The plans call for enlargement of Pier No. 14 and the installation of new ore handling machinery costing about $915,000. Extensive repairs to the existing equipment also is planned. A new 1,000-hp. boiler will be installed, costing about $915,000.

The general machinery situation in Philadelphia appeared to be unchanged from what it was two weeks ago. Automobile production is keeping up. The production of automobile tops is considerably in advance of what it was at this time in 1923, and prospects are good for a brisk business during the spring. Prices are steady.

Shops producing iron pipes are booked up with orders for early spring. Municipal water projects and other utilities have been the biggest users. Generally speaking, the underlying economic conditions in Philadelphia are satisfactory, and indications are for development of staple conditions.

Detroit

While all automobile production figures continue to be broken, a slight lull is noted in the machine tool field, with conditions being described as "spotty."

Everything in the automobile industry is going up. This includes costs, materials, labor, production, shipping, sales, prices, and demand for cars. On the eve of what is expected to be the biggest season the automobile business has ever seen, factory wheels are spinning at the highest speed on record.

That this increased production should have a material effect upon the machinery market is obvious, yet an absence of any large order is an outstanding feature. In this regard the past week has been a letup from former ones.

Leaders in the field declare conditions fair, with the probability that an improvement is in store within the very near future very bright.

Factories manufacturing parts for the larger automotive concerns are buying machinery more than any other group at present, a survey indicates.

Railroads report excellent business conditions throughout the state; employment figures remain around the 240,000 mark; while all financial statistics attest to Detroit's prosperity.

Annual Reports Show Industry's Strength

The annual report of the New York Air Brake Co. for 1923 shows total income of $4,013,697, against $2,242,991 in 1922, and net profits of $2,526,487 after all deductions, against $958,741 in the previous year. The net profits for 1923 were equal to $8.42 a share earned on the combined Class A and common stocks, against $4.37 in 1922.

The balance sheet showed net current assets of $8,550,102, of which $3,625,087 was cash, $2,400,177 accounts receivable, $550,161 securities and inventories, $1,974,676. Current liabilities of $547,970 included $445,046 accounts payable and $102,924 accrued accounts not due.

Mack Trucks, Inc., reports for 1923 gross sales of $43,866,957, against $31,070,289 in 1922, and net earnings, after all expenses and reserves for depreciation, of $8,053,665, against $4,517,279 in the previous year. After reserves for Federal taxes and other deductions the company reported net profits of $7,003,665, which, after allowing for preferred dividends, left a balance equal to $20.71 a share earned on the 283,109 shares of no par value common stock outstanding. In 1922 the company, after preferred dividends, reported a balance equal to $9.94 a share earned on the common stock outstanding at the close of that year. After common and preferred dividends there was reported a surplus of $4,425,774 in 1923. The total profit and loss surplus was $18,076,423, against $11,791,254 at the close of 1922.

The J. I. Case Threshing Machine Co. for 1923 reports gross sales of $15,587,952, against $15,720,716 in 1922. After all operating expenses there was reported a profit of $1,370,806, against $860,283 in 1922. After reserves for interest, depreciation and other deductions, the company reported net profits of $634,633, against $321,269 in 1922. The net profit for 1923 was equal to $4.88 a share on the $13,000,000 preferred stock, against $2.47 a share in 1922. The company recently passed dividend payments on the preferred stock.

Oakland Considering Motor Plant

So great has been the demand for the new 1924 Oakland cars that factory heads are seriously considering taking over the motor plant of the Saginaw Products Co. at Saginaw, Mich., for the production of parts of motors in case the motor plant at Pontiac cannot supply all that are needed for the present production schedule. The proposed new plant has been closed for some time. If it is taken over, explained C. J. Nephler, general sales manager, it will be prepared for an auxiliary plant to supply Oakland motor parts and probably motors in case of emergency. It is not the intention of the Oakland Motor Car Co. to manufacture cars in the Saginaw plant, neither now nor in the future.

Gurney Company Bought by Marlin-Rockwell

Directors of the Marlin-Rockwell Corp. have completed the purchase of the Gurney Ball Bearings Co. of Jamestown, N. Y. The Marlin-Rockwell organization has called a special meeting for March 28, at which stockholders will be requested to approve the consolidation.

For the property and other assets of the Gurney company, Marlin-Rockwell will give $2,722,800 in 7 per cent cumulative preferred stock and 133,683 shares of no par value common stock. The Marlin-Rockwell at the same time will assume all debts and other liabilities of the smaller company. Marlin-Rockwell stockholders will be requested to authorize the issuance of the amount of preferred stock mentioned above and at the same time authorize an increase in the no par value common stock from 89,251 to 222,805 shares.

Announce Subjects for A. S. M. E. Meeting

Some of the subjects to be discussed at the spring meeting of the American Society of Mechanical Engineers, to be held in Cleveland May 26-29, are—"Power Problems in the Steel Industry," "Interchangeable Manufacture," "Windmill and Fan Design," and "Materials Handling in Industry." Joint sessions will be held with both the American Society for Testing Materials and the American Society of Refrigerating Engineers.

Annual Meeting of Industrial Engineers

The eleventh national convention of the Society of Industrial Engineers will be held at the Hotel Statler, Buffalo, N. Y., April 30 to May 2. The major subject, "Reducing the Cost of Business," will embrace papers and discussions dealing with the various departments of business—administration; sales; production; and personnel.

On each of the three days of the convention, inspection trips will be made through some of the most modern plants in Buffalo and Niagara Falls.

German Railroads Using Trucks

While German railroad officials have for some years considered the motor truck a competitor which should be destroyed, it has been the prevalent feeling recently that the two agencies of transportation must co-operate, according to Dr. Albert Sommer of Dresden, Germany, in an address before the motor truck members of the National Automobile Chamber of Commerce. Dr. Sommer is executive manager of a large German trucking corporation similar to the United States Trucking Corp. of New York City, and is in this country to familiarize himself with the American automotive industry.

American manufacturers have nothing to fear from competition from Germany in the making of motor trucks at present, Dr. Sommer believes. "The cheapest new truck in Germany costs at least $5,000, and then one must wait months for the factory to fill the order," he says.

"About one year ago the use of trucks by railroads in the City of Berlin began and to-day can be pronounced a thorough success," asserts Dr. Sommer. Trucks are used to avoid trap car service between freight stations in various parts of Berlin. Each individual truck unit consists of a 5-ton motor truck and two trailers, all closed like freight cars, operated and guarded by the truck corporation's men who for this business are under the orders of the railway management, wearing the railway uniform. The truck corporation acts as a joint carrier with the railroad and receives a tariff proportionate to the prevailing railroad tariff. Through this use of trucks about 40 railroad cars are saved for long haul purposes in Berlin alone.

A much larger program of co-operation between railroads and motor trucks throughout all Germany has been developed. "This involves," says Dr. Sommer, "use of trucks to replace local freight trains similar to plans put into effect recently by the New York Central and Pennsylvania Railroads."

Foreign Trade Council Plans for Meeting

The National Foreign Trade Convention will be held at Boston, June 4, 5 and 6, next.

Indications are that this will be one of the most successful conventions yet held. This is the first time the convention has been held in New England. The central theme of the convention will be, "Our Need for Wider Markets."

This is also the first time that a session specially devoted to the interests of importers has been included in the program. It will be held in co-operation with the National Council of American Importers and Traders.

In sending the call for the convention to all Americans engaged in foreign trade, or connected with any factor of our international commerce—agriculture, education, industry, finance, or transportation — James A. Farrell, president of the United States Steel Corp. and chairman of the National Foreign Trade Council, has cordially invited all Chambers of Commerce, Boards of Trade, National and State associations, and other industrial and commercial organizations, to be represented

Mr. Farrell declared that the present foreign trade situation of the United States offers an inspiration and encouragement to American foreign traders.

Machinery Exports Are Improved

Exports of metal-working machinery during January, 1924, with revised comparative figures for January, 1923, as compiled by the Department of Commerce, are as follows:

	January, 1923	January, 1924
	Value	Value
Lathes	$57,992	$76,904
Boring and drilling machines	57,922	54,849
Planers, shapers and slotters	15,965	12,778
Bending and power presses	23,205	9,764
Gear cutters	5,550	24,380
Milling machines	64,983	32,072
Threadcutting and screw machines	28,499	133,029
Punching and shearing machines	34,902	4,697
Power hammers	7,960	24,124
Rolling machines	.....	86,000
Sharpening and grinding machines	70,233	.....
Chucks, centering, lathe, drill, etc.	19,900	25,479
Reamers, cutter, drills, taps, dies and other metal working tools	123,882	212,952
Pneumatic portable tools	26,817	100,305
Foundry and molding equipment	9,799	23,578
Other metal working machinery and parts of	392,873	347,818
Total metal working machinery	$940,482	$1,215,126
Automobiles and chassis (total)	$5,257,146	$11,033,929

Italians and French in Merger

Two important international elements hitherto known in the electro-metallurgical field have fused their respective issues and belongings—the new association to be known as the Societe des Acieries Electriques Cogne-Girod at Aoste in the Italian Alps.

The new organization is the outcome of the fusion of the Gio Ansaldo company of Italy and the Etablissements Paul Girod of France. The former at the end of the war had established an electric steel plant at Cogne in the Val d'Aoste, where had been discovered an important deposit of highly magnetic iron. The latter had an important electric steel plant at Ugines in Savoy in the French Alps.

Russia Buys Farm Machinery

The *Selskosoyous* (Village Unions) are making an effort to supply the Russian interior market with machinery and tools for agriculture. With the aid of a credit of 400,000 gold rubles extended by the State Bank for the import of agricultural tools and machinery, the *Selskosoyous* has purchased 25 tractors, 50 binders, 10 motor-ploughs, and 500 lb. of twine for binding sheaves.

Auto Maintenance Show for Detroit

An Automotive Maintenance Equipment Show has been decided upon and will be held in Detroit, Mich., in the General Motors Building, May 19-23 in which six national organizations will participate and at which subjects relative to service and maintenance will be discussed. At the same time in Detroit the National Automotive Service Convention will be held May 19, 20, 21 and 22 and also the World Motor Transport Congress, May 21 to 24.

The six organizations that have signified their intention of participating in the maintenance show are: The National Automobile Chamber of Commerce, the Society of Automotive Engineers, the Motor and Accessory Manufacturers' Association, the Automotive Equipment Association, and the Service Equipment Associates.

There will be exhibits of service equipment manufactured by the members of the participating associations. In the preliminary circular recently issued it states under the heading, "Purpose," the following:

"To place before delegates from the United States and many other nations to the conventions, the latest and best equipment suited to their requirements. The delegates will consist of factory service managers and engineers, representatives of dealer, trade and service associations, distributors and dealers, field service managers and shop superintendents, garage and repair shop owners and their mechanics, proprietors and managers of electrical, battery and other kinds of service stations, and service managers for fleet owners.

"Among the delegates attending the World Motor Transport Congress will be factory export managers, including their technical advisors, representatives of foreign automotive associations, foreign dealers in automotive products and government officials concerned with motor transport."

Export of Farm Tools Increases

Exports of agricultural implements from the United States in January again increased, amounting to $4,369,386, compared with $3,336,188 in December, and with $2,844,284 in January, 1923, according to Gerbe B. Bell, Chief of the Agricultural Implement Division of the Department of Commerce. This is almost double the exports in January, 1923, and three times those for January, 1922. In the latter month, exports were almost at the lowest point reached during the period of depression, and in the first month of 1923 were well along on the road to recovery, so the exports for the first month of 1924 have reached a very healthy figure. The value of implements exported during the seven months ended January, 1924, was $32,135,462, while in the same period of 1923 it amounted to $18,033,798. This total for the period ending in January, 1924, is greater than the total exports of implements in 1922, and is more than 60 per cent of the exports in 1923.

Business Items

The Doehler Die Casting Co., Brooklyn, has acquired two new plants, one in Batavia, N. Y., and the other at Pottstown, Pa. The Pottstown factory was formerly the die casting department of the Light Manufacturing & Foundry Co. and will henceforth be known as the Light Manufacturing & Foundry Division of the Doehler Die Casting Co. The Batavia branch will specialize in the production of aluminum die castings.

The McMyler-Interstate Co. has moved its Chicago office to 468 Railway Exchange Building.

The Pawling & Harnischfeger Co., Milwaukee, Wis., has purchased from the receivers, the entire property of the Hercules Steel Casting Co., Milwaukee.

The Franklin Automobile Co., Syracuse, N. Y., has recently expended over $100,000 for various conveyor installations throughout the shops.

In a directory of the industries of West Virginia, which has just been issued by the State Bureau of Labor, the manufacturers of iron and steel products and the machine shops and foundries of the state are listed. As well as being arranged by industries, the directory is arranged to give the name and address of the company.

Four large buildings of the Wabash Railway shops at Decatur, Ill., were destroyed by fire on Feb. 26. The fire destroyed the East car shops, the coach shop warehouse, the water service building, the office building and the blacksmith shop with equipment valued at $200,000. Twelve passenger coaches and a number of freight cars were also badly damaged. The total loss is estimated at $750,000.

The Hec Manufacturing Co., of Atlanta, is being completely reorganized, and plans purchase at an early date of considerable new equipment, officials of the company have announced. Head quarters are at 1205 Fourth National Bank Building. Purchases to be made will include shearing, punching and bending machinery for sheet metal, also drilling machinery, etc.

The manufacture of oil storage tanks and other arc welded steel plate products will be started this week by the Emerson-Scheuring Tank Co., Indianapolis, Ind., recently incorporated for the purpose in a part of the plant of the Burpee-Johnson Co., manufacturer of shock absorbers. The company occupies about 6,000 sq.ft. of floor space and has placed orders for about $10,000 worth of machinery and other equipment for electric arc welding purposes. W. J. Emerson is president; C. E. Scheuring, vice-president and general manager, and M. R. Scheuring, secretary and treasurer.

The Triumph Electric Co., Cincinnati, Ohio, announces issuing a complete revision of prices covering its entire line of motors.

The Union Trust Co. has been appointed receiver for the Midwest Engine Corp., Indianapolis, successor to the Midwest Engine Co., by Judge Mahlon E. Bash, in the probate court. Charles W. Jewett was appointed co-receiver.

It is announced that the plant of the Harmer Knowles Trucks, Ltd., Toronto, will be moved to the site of the Malleable Iron Works, Midland, Ontario.

The Ohio Body Co., Cleveland, Ohio, has announced the appointment of the Michigan Master Body Co., 1440 Michigan Ave., Detroit, Mich., as Michigan distributor for its product.

Contracts to furnish disc wheels for Auburn and Apperson motor cars have been closed by the Indestructible Wheel Co. of Lebanon, Ind.

The Curley Pump Co. has opened salesrooms at 826 Massachusetts Ave., Indianapolis.

The Canadian Locomotive Co., Ltd., Kingston, Ontario, has received a contract from the Canadian National Railways for fifteen mountain-type passenger locomotives and five Sante Fe type freight engines. It is stated the freight engines will be the largest and heaviest type ever built in Canada.

Orders for 24 cars have been placed by the Canadian National Railways with the Canada Car & Foundry Co., Montreal. This order calls for the building of ten first-class passenger cars, ten second-class passenger cars and four compartment cars.

Obituaries

JOHN M. MACK, president of the J. M. Mack Corp., Allentown, Pa., and formerly president of the International Motor Co., maker of Mack trucks, was instantly killed March 14, twelve miles from Allentown when a coupé he was driving was hit by a work car of the Lehigh Valley Transit Co. Mr. Mack founded the International Motor Co. and later he and his brother Joseph Mack sold their interests to the company for $700,000. He was the inventor of the Mack "Bulldog" type engine.

JOHN F. ALVORD, president of the Torrington Co., Torrington, Conn.; the Progressive Manufacturing Co., Torrington, Conn.; the Splitdorf Electric Co., and the Electric Arc Cutting & Welding Co., New Jersey, and a director of the Wire Wheel Corp., and the Union Hardware Co., died suddenly March 13 at his home in New York City. Mr. Alvord was 63 years of age and was well known in financial and industrial circles.

LOWELL H. STEARNS, treasurer of the Fitchburg Machine Works, Fitchburg, Mass., died recently in that city. He was sixty-six years of age.

JAMES P. PHELAN, 58 years old, of Indanapolis, Ind., died recently after an illness of several weeks. Mr. Phelan was at one time connected with the old Atlas Engine Works. He retired from business a number of years ago.

Personals

LANE SCOFIELD is in charge of the newly established Chicago office of the Reed-Prentice Co., Worcester, Mass. The new office is located at 204 Machinery Hall.

S. A. EMERY has joined the sales force of the Royersford Foundry & Machine Co., Philadelphia, Pa. He was formerly Eastern manager of the Dodge Manufacturing Co., Mishawaka, Ind.

J. ALEXANDER WILSON and WILLIAM BROWN have formed a company known as Wilson-Brown, Inc., 2 Rector St., New York City. They will represent the Bradford Machine Tool Co., the Carlton Machine Tool Co., the Cincinnati Shaper Co., the Cincinnati Gear Cutting Machine Co., and the Liberty Machine Tool Co.

EMIL VILTER, president and general superintendent of the Vilter Manufacturing Co., Milwaukee, manufacturer of ice and refrigerating machinery, Corliss engines, etc., expects to leave at the close of March for the Far East on a combined recreation and business trip in China and Japan, with special reference to a study of possibilities for the sale of equipment manufactured by his company.

WILLIAM MONROE WHITE, chief engineer of the hydraulic division of the Allis-Chalmers Manufacturing Co., Milwaukee, has been appointed official delegate of the Engineers' Society of Milwaukee to the World Power Conference at London, Eng., next July, and the World Conference on Management at Prague, Czecho-Slovakia, which will follow the London convention.

HENRY W. BURRITT, who has been secretary-treasurer of the Gray Motor Corp., Detroit, has been given the added duties of general manager, succeeding W. N. MCMUNN, resigned.

J. M. MCHENRY has become a member of the board and consulting engineer of the W. H. Kratzer Co., Detroit. Mr. McHenry was formerly a resident of St. Louis, Mo.

ALFRED E. LINDAU, vice-president of the Corrugated Bar Co., Buffalo, has been named by the Buffalo Engineering Society as its representative on the American Engineering Council.

FRED WILSON, who for many years has been intimately identified with automotive factories, has been elected vice-president in charge of sales and advertising by the directors of the Columbia Motors Co. of Detroit.

GEORGE W. WAY has been appointed Detroit district representative of the Union Drawn Steel Co., succeeding W. J. BOTHWELL, resigned. Mr. Way has been with the company for three years and previously was with the Carnegie and other steel companies. His offices are at 237 Jos. Campau Ave.

W. L. GOODRICH and W. H. RIEGER have been appointed special representatives for the die block, shoe and trimmer steel departments of the Colonial Steel Co., Pittsburgh.

T. R. HARRISON has assumed charge of the research department of the Brown Instrument Co., Philadelphia, Pa. Mr. Harrison was formerly associated with the pyrometry department of the Bureau of Standards and more recently with the Champion Porcelain Co., Detroit, Mich.

L. H. WELLING has been appointed Eastern manager, with headquarters in New York City, for the Graver Corp., of East Chicago, manufacturer of tanks, water softeners, etc.

W. A. DOBLE, formerly of San Francisco, is with the Doble Steam Motors in Emeryville, Calif.

C. M. KRINER is with the Power Equipment Co., Boston.

PRESTON M. SMITH has become sales manager for the U. S. Tool Co. at Newark, N. J.

E. R. FREDERICKS, who came over to this country recently with the group of 15 engineers from the André Citröen Works, remains in charge of the New York office, 250 W. 57th St. The other members of the party sailed for France on March 12.

FREDERICK E. WRIGHT has joined the sales department of the International Oxygen Co., Newark, N. J.

W. I. THOMAS, formerly manager of the Spaulding Fibre Co., Chicago, has organized the W. I. Thomas Co. with headquarters at 217 North Desplaines St., Chicago, and will act as distributor for fibre and insulating materials.

W. A. RUPPEL has been transferred from the Chicago office to the home office of the Abrasive Co., Philadelphia, Pa.

H. F. STRATTON, formerly vice-president and chief engineer of the Electric Controller & Manufacturing Co., Cleveland, has been elected president.

MRS. JESSIE B. WADSWORTH, widow of Harold B. Wadsworth, who died following the earthquake in Yokohama, will continue the general machinery exporting and domestic wholesale machinery business in New York City.

ANTHONY S. HILL has left New York to go to Canton, Ohio, with the Knight Manufacturing Co.

ALEXANDER HARPER, general manager of the American Silver Co., has been elected president of the Bristol Brass Co., Bristol, Conn., succeeding Albert T. Rockwell.

C. W. QUINN, formerly with Craig, Becker & Co., has been appointed general manager of H. B. Wadsworth & Co., New York City.

CLAIBORNE PIRTLE has resigned as president of the Electric Controller & Manufacturing Co., Cleveland, and will become chairman of the board of directors.

EARL L. SPARKS, formerly with the Erie Steam Shovel Co., Erie, Pa., has been appointed Eastern district manager for the Bucyrus Co., Milwaukee, with headquarters at 30 Church St., New York City.

CHARLES F. ROGERS is sales representative for the W. B. Knight Machine Co., with headquarters in Milford, Conn.

H. D. SMITH has been appointed salesman to represent the Colonial Steel Co. in the western half of Connecticut. His headquarters will be in New Haven, Conn.

Vauclain Optimistic for the Year

At the annual meeting of the Baldwin Locomotive Works, held in Philadelphia last week, President Vauclain stated that he expected to book between $73,000,000 and $75,000,000 of business this year.

In the last nine months of 1923, President Vauclain said, new business booked was equal to about 17½ per cent of capacity, while in January and February new business booked was equal to about 70 per cent of estimated capacity for this year. Foreign business also is improving, said Mr. Vauclain. At the meeting the directors were re-elected.

Catalogs Wanted

W. Gerhard, Ludenscheid, Westphalia, Germany, requests catalogs and price lists on the following products: Calculating machines and typewriters; equipment for drafting rooms, commercial offices and factory shops; cranes and hoisting equipment (particularly for handling heavy wire coils up to 129 kilograms); trucks for sheets in the pickling rooms of rolling mills; machines for making wire nails, barbed wire and fencing; machines and appliances for cleaning castings in cast iron foundries.

Trade Catalogs

Acetylene Welding Generators. The Alexander Milburn Co., 1416-1428 West Baltimore St., Baltimore, Md. A small booklet showing the company's welding products and parts together with a list of users and some of the other tools manufactured by the concern. Cutting torches, garage repair kits, oxygen regulators, gages, adapters, preheaters and acetylene lights are described and illustrated.

Internal and Link Grinder for Railroads. The Gisholt Machine Co., Madison, Wis. A folder showing the grinder used in railroad repair work. A half-tone illustration, a diagram, and text make clear the points the company wishes to emphasize.

Lubricators. The Carr-Fastener Co., 31 Ames St., Cambridge, Mass. "Better Lubrication for All Machinery" is the title of this booklet in which are shown various machines being lubricated with the gun made by this company. Detailed illustrations show the parts of the gun and the assembled product. The text describes the advantages.

Automatic Counters. The Root Co., Bristol, Conn. Counters for every sort of production are shown in this catalog that has recently been issued. The text and illustrations show the adaptability of the counters to various lines of work.

Electric Drills. The Black & Decker Manufacturing Co., Towson, Md. A brochure of exceptional merit, artistically produced in which appears reproductions of letters received from customers in all parts of the country. A heavy paper art cover 9¼x12¾ in. has been used and the title of the booklet is "Appreciation."

Steam Heating Systems. Warren Webster & Co., Camden, N. J. Views of twenty-four cities are shown in this booklet and it is the claim of the company that its heating systems are to be found in the leading buildings in each city. The booklet is exceptional in many ways.

Screw Cutting Tools and Machines. Geometric Tool Co., Westville Station, New Haven, Conn. The catolog is very complete showing the many products of this company. The illustrations are clear and easily understood while the text is illuminating. Data useful to the metal-working industry are also included.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Pumping machinery. Cairo, Egypt. Purchase. Reference No. 9313.

Machinery for manufacturing wood and iron screws. Athens, Greece. Purchase. Reference No. 9365.

Machine tools and shop equipment. Kattowitz, Silesia. Agency. Reference No. 9387.

Tools and devices for wood and metal working. Vienna, Austria. Agency. Reference No. 9391.

Forthcoming Meetings

National Metal Trades Association. Twenty-sixth annual convention. Hotel Astor, New York City, April 23 and 24. L. W. Fischer, National Secretary, Peoples Gas Building, Chicago, Ill.

American Gear Manufacturers Association. Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio, May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924. Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

National Association of Purchasing Agents. Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer 1315 Spruce St. Philadelphia, Pa.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron buying mostly confined to small lots at present, with price of No. 2 f'd'y at minimum of $23.50 per gross ton, Birmingham. Volume of new inquiries for steel structurals not up to expectations, although price is still firm at $2.50 per 100 lb., Pittsburgh mill. Substantial demand for plates evident, particularly from railroads and ship builders. Bar quotations mostly at $2.40 per 100 lb., f.o.b. mill. Quotations have been heard, on exceptional tonnages, reaching as low as $2.25 for plates, $2.30 for shapes and $2.35 per 100 lb. on steel bars.

Non-Ferrous Metals—Break in tin market; copper and lead also easier than a week ago; antimony quiet. Zinc dropped $1 per ton March 13.

Miscellaneous—Raw linseed oil, 95c. per gal. (5 bbl. lots) f.o.b. New York, effective March 13, against 97c. per gal. during the preceding week.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	23.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	3.00	4.34	3.75	4.00
No. 12	3.10	4.39	3.80	4.05
No. 14	3.20	4.44	3.85	4.10
No. 16	3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.60	4.65	4.45	4.70
Nos. 22 and 24	3.65	4.70	4.50	4.70
Nos. 25 and 26	3.70	4.75	4.55	4.75
No. 28	3.75	4.85	4.65	4.85
Galvanized				
Nos. 10 and 11	3.90	4.90	4.70	4.85
Nos. 12 and 14	4.00	5.00	4.80	4.95
Nos. 17 and 21	4.30	5.30	5.10	5.24
Nos. 22 and 24	4.45	5.45	5.25	5.40
No. 26	4.60	5.55	5.50	5.55
No. 28	4.90	5.85	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55@60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.75
Tin, 5-ton lots, New York			57.00
Lead (up to carlots), St. Louis	9.25	New York	9.75
Zinc (up to carlots), St. Louis	6.55	New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	28.00	29.00	28.50
Antimony (Chinese), ton spot	12.12½	13.25	10.25
Copper sheets, base	21.75	22.00	23.00
Copper wire, base	17.25	19.75	16.25
Copper bars, base	20.75	23.25	19.50
Copper tubing, base	23.75	28.00	23.00
Brass sheets, base	18.25	22.50	18.75
Brass tubing, base	22.50	27.50	20.50
Brass rods, base	16.00	18.50	15.75
Brass wire, base	18.75	22.50	....
Zinc sheets (casks)	10.75	11.00	....
Solder (½ and ½), (case lots)	39.00	41.50	30.00
Babbitt metal (83% tin)	60.00	68.00	48@52
Babbitt metal (35% tin)	28.00	22.00	22@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.00	11.50	11.50
Copper, heavy, and wire	10.75	11.00	10.75
Copper, light, and bottoms	9.75	10.00	9.75
Lead, heavy	7.75	7.00	6.00
Lead, tea	6.50	4.50	5.00
Brass, heavy, yellow	7.00		7.25
Brass, heavy, red	9.25	10.00	9.00
Brass, light	6.00	6.00	6.25
No. 1 yellow brass turnings	7.00	6.50	6.75
Zinc	4.00	3.50	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.12½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	11.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	11.50	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.50	3.50
Linseed oil, per gal., 5 bbl. lots	.95	1.08	.94
Lard cutting oil, 25% lard, per gal.	.58	.50	.67½
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50%	50–10%	40–10%
Second grade	50–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		4.00@4.50
Coke, prompt foundry, Connellsville	per net ton		5.25@6.50
White lead, dry or in oil	100 lb. kegs	New York, 15.00	
Red lead, dry	100 lb. kegs	New York, 15.00	
Red lead, in oil	100 lb. kegs	New York, 16.50	

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0334
Cold finished shafting	per lb.	0.044	0.044	0.042
Brass rods	per lb	0.16	0.15	0.1937½
Solder (½ and ½)	per lb.	0.39	0.3675	0.35
Cotton waste	per lb.	.14@.21	.14@.21	.10@.1
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.58	0.58	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1⅛ and 1¼x3 in. up to 12 in.	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 of
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	45%	.....	60–5%
Square and hex. head cap screws	60%	75%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	05%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, $\frac{9}{16}$ and smaller	65%	.....	.....
Semi-finished nuts, $\frac{5}{8}$ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, $\frac{5}{8}$ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1¼ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
$\frac{5}{8}$ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$3.70 base

New and Enlarged Shops

Machine Tools Wanted

Ind., Indianapolis—Cincinnati, Indianapolis & Western R.R. Co., 220 Virginia Ave., H. Lewis, Mgr. Purch. & Supplies—motor driven hydraulic wheel press.

Ind., Indianapolis—Terre Haute, Indianapolis, Eastern Traction Co., Traction Terminal—48 in., 300 ton wheel press.

Ky., Maysville—Ohio Valley Pulley Wks. —several inclinable open back punch presses.

Ky., Owensboro—T. J. Lea—drill, press, reboring mill and lathes, all motor driven, for garage.

Mass., Boston—Boston Elevated Ry. Co., 31 St. James Ave., E. Dana, Genl. Mgr.—lathes, planers, shapers, boring mills, drills, presses, power hammers, pulleys, shafting and belting for new repair shops at Everett (list not complete).

Minn., St. Paul—Dept. Educ., L. R. S. Ferguson, Comr., City Hall—woodworking, sheet metal and machine shop equipment for proposed schools.

Mo., Kansas City—Turner Mfg. Co., 3029 Roanoke Rd., A. Zimmer, Supt.—screw machine 3¼ in. capacity, Foster preferred; Barbour Coleman hubbing machine, 3¼ in. capacity.

N. Y., Brooklyn — M. Kamenstein, 135 Pearl St.—drawing press equal to Bliss No. 4 or larger (used).

N. Y., Buffalo—C. Hehr, 227 Rapin St.—machinery for sheet metal shop.

N. Y., New York—Wilson Mfg. Co., 137 Grand St.—No. 21 and 21 B press, also No. 4 V. & O. press.

O., Cleveland—Guide Motor Lamp Co., 2130 West 110th St.—one Horning press, one straight line press, 6 in. stroke.

O., Cleveland—Richman Bros. Co., 1600 East 55th St. — Heisey-Wolf portable grinder, type O-A, ¼ hp.

O., Columbus—McClure-Nesbitt Co., 504 East Main St., J. A. McClure, Purch. Agt. —24 in. lathe, milling machine, etc., for service station.

O., Columbus—Bobb-Chevrolet Co., 509 East Whittier St., G. W. Bobb, Pres.—small grinder, 18 in. lathe, air compressor and milling machine for new service station.

O, Columbus—Ohlen-Bishop Co., Buttles Ave.—drill press for reaming center hole in circular saws.

O., Leetonia — Leetonia Tool Co., 160 Front St.—16 or 20 in. shaper and 6 in. stroke hacksaw.

O., Warren—Amer. Roll & Machine Co., R. F. Shook, Genl. Mgr.—two lathes, one milling machine, etc.

R. I., Providence—Providence Gas Co., Weybosset Court—large and small lathe, large planer, bench lathes, shaper, drill presses and small tools for automobile repairs; also pulleys, belting, shafting, hangers, etc. (list not complete).

R. I., Woonsocket—Jannell Body Mfg. Co.—wood and metal working machinery, including floor and bench lathes, small planer, shaper, drill presses, hacksaw, band, rip and cutoff saws, benches, pulleys, shafting, belting, hangers, etc. (list not complete).

W. Va., Charleston—Kanawha Equipment Co., Virginia Land Bank Bldg.—100 ton hydraulic wheel press.

Wis., La Crosse—Fox Bros., 129 North 3rd St.—press, chain hoist, air compressor, gasoline storage tanks and pumps for proposed $150,000 garage.

Wis., Milwaukee—Central Bd. of Purchases, J. Nicholson, Purch. Agt., City Hall—one new arbor press.

Wis., Milwaukee — W. D. Mann, 204 Grand Ave.—woodworking and sheet metal working machinery.

Que., Montreal—J. G. Vaillant, 1585 St. Hubert St.—complete equipment for garage, also free air outfit, gas and oil tank.

Machinery Wanted

Calif., Merced—Merced School Dist.—one Tannewitz type F variety saw bench; Huther dado head No. 3 set, 8 in. diameter to cut off sixteenths; Tannewitz 30 in. bandsaw; L. Power & Co. 12 in. improved joiner; Wells No. 211 manual training lathe, 12 in. swing, for John Muir School.

Calif., San Francisco — Twentieth Century Bakery Co., 1650 Polk St.—four ovens and oil burning equipment for proposed $55,000 bakery.

Conn., Hartford — L. F. Dettenborn Woodworking Co., 337 Sheldon St.—machinery for proposed $60,000 to $70,000 factory.

Conn., New Haven—Jennings, Smith & Lee, Inc., 321 Winthrop Ave., W. Smith, Treas.—machinery and equipment for the manufacture of cabinets, screen doors, etc.

Conn., Waterbury—Maloney and Bunker Hill Schools, T. and F. Freney, 51 Leavenworth St., Purch. Agts.—drills, lathes, presses, etc., for manual training departments.

D. C., Wash.—Southern R.R., Southern Bldg., C. R. Craig, Genl. Purch. Agt.—10 ton crane.

Ill., Mound City—Mound City Crystal Ice Mfg. & Coal Co.—complete machinery and equipment for 4 stand cotton gin.

Ill., Springfield—St. Joseph Hospital, c/o J. Straub, Dir.—laundry machinery, dryers, etc., for proposed $50,000 laundry at Chippewa Falls, Wis.

Ky., Wallins Creek—Banner Fork Coal Co.—coal handling, transmission and conveying equipment for coal mines near here.

Mass., Boston — New England Coal & Coke Co., 111 Devonshire St.—equipment, including conveying machinery, for plant at Everett.

Mich., Detroit — E. DeLong, 5518 Van Dyke Ave.—friction drive, motor driven drop hammer, 125 to 200 lb.

N. H., Berlin—School Com.—soon receives bids for manual training equipment, including several small lathes for wood and metal work; band, rip and cutoff saws; planer and matcher; tables, benches, pulleys, shafting and small tools, for proposed $250,000 high school.

N. Y., Buffalo — Commissioner of Pub. Wks.—receiving bids until Apr. 17, equipment for asphalt repair plant, including three belt driven steam jacketed mixers, 9 cu.ft. capacity; three gear driven rotary drum mixers; melting kettles; dust, barrel, hot and cold material elevators; motors; flux pumps; air compressors; electric crane; ten 5 ton trucks; fifteen Fordson tractors; seventeen asphalt wagons; three 2½ ton and one 5 ton roller; fifteen doz. asphalt shovels, six doz. rakes and three doz. tampers and smoothers.

N. Y., New York—American Machinist is willing to publish requirements for transformers and other electrical machinery if such sales leads are of value to its readers. If you want them, address A. W. Welch, McGraw-Hill Co., 10th Ave. at 36th St., New York.

N. Y., New York — L. Robertson, 540 West 22nd St. (machinist)—small electric post drill, ⅝ in. check capacity, arm about 18 to 20 in.

N. Y., Sackett Harbor — Imperial Fox Biscuit Co., Main St., N. Dearborn, Purch. Agt.—complete mixing, moulding and baking machinery for biscuit bakery.

N. Y., Watertown—Watertown Flint Co., Stone St., V. E. Quiri, Purch. Agt.—bench planer, direct electric drive, for garage and repair shop.

O., Columbus—J. E. McNally Lumber Co., 1670 Snider Ave.—two stickers and one planer.

O., Elyria—Columbia Steel Co., Liberty St.—portable alligator shear.

O., Toledo — Libbey-Owens Sheet Glass Co., 1401 Nicholas Bldg.—one 2 ton and two 5 ton cranes, one 10 ton overhead traveling electric crane, feed water pump and heater, 1,500 kw. generator sets, transformers, two condensate pumps and two stokers.

Okla., Quapaw—Quapaw Mining Corp.—electric hoist, 110 to 115 hp. motor.

Pa., Brackenridge—Allegheny Steel Co. —one soaking pit crane.

Pa., East Pittsburgh — Westinghouse Electric & Mfg. Co.—one 75 ton, one 50 ton, one 30 ton, four 15 ton, three 5 ton and two 3 ton electric cranes for Sharon plant.

Tex., El Paso—El Paso Cotton Mill Co., A. P. Coles, Pres.—looms and other equipment for cotton mill.

Vt., Bennington—J. A. Shoemaker, Inc. (woodworking)—one 30 in. drum sander for soft wood.

Vt., Proctor—Vermont Marble Co.—two ton electric overhead crane.

Wash., Seattle — Frye & Co., 9th and Walker Sts.—mechanical equipment for proposed packing plant and warehouse at San Francisco.

Wis., Granville—Granville Canning Co., A. J. Kreutzer, secy.—canning and conveying machinery for proposed pea canning plant.

Wis., La Crosse — La Crosse Co., J. Hintgen, Hy. Comr.—limestone crushing machinery.

Wis., Milwaukee — H. R. Mayer, 1014 20th St. (woodwork)—16 in. jointer.

Wis., Milwaukee—Quality Press Co., 373 Mitchell St., S. F. Drozeski, Purch. Agt.—ash hoisting machinery.

Wis., Waupun — Waupun Canning Co., F. T. Clark, Pres.—motor driven canning machinery, sterilizers, etc., for proposed $100,000 factory.

N. B., St. John — McNamara Bros. — portable sawmill for plant at Nerepis.

Metal Working Shops

Calif., Oakland—The Marchant Fdry. Co., 4th and Landregan Sts., awarded the contract for the construction of a 1 story foundry. Estimated cost $15,000.

Calif., Oakland — The Pacific Malleable Casting Co., c/o G. Peterson, Contr., 351 12th St., awarded the contract for the construction of a 1 story foundry on 85th Ave. Estimated cost $35,000.

Calif., San Francisco—W. Lowe, Archt., Monadnock Bldg., is receiving bids for the construction of a 2 story, 113 x 149 ft. factory on Howard and 10th St., for the manufacture of automobile bodies, for Fisher-Gaffney Co., 555 Bryant St. Estimated cost $80,000. Noted Mar. 6.

Pa., Erie—The Erie Steam Shovel Co. had plans prepared for the construction of a 1 story, 200 x 300 ft. factory. Estimated cost $100,000. M. Armstrong, Mgr. Osborn Eng. Co., 7016 Euclid Ave., Cleveland, Engrs. and Archts.

Pa., Pittsburgh — B. H. Prack, Archt., Keystone Bldg., is receiving bids and will open same about Mar. 25 for the construction of a 2 and 4 story, 28 x 62 ft. and 82 x 282 ft. addition to plant on Lang Ave. for the Westinghouse Electric & Mfg. Co., East Pittsburgh.

Tenn., Chattanooga — The Hardwick Stove Co. awarded the contract for the construction of a 1 story, 80 x 230 ft. addition to its stove works. Estimated cost $75,000.

Wis., Madison—J. Peterson, 102 South Orchard St., is having plans prepared for the construction of a 6 story, 66 x 122 ft. garage and repair shop on Fairchild St. Estimated cost $150,000. Private plans. Noted Jan. 31.

Wis., Milwaukee—The Dunning Heating Supply Co., 131 Reed St., plans to build a 2 story, 98 x 200 ft. factory on 40th Ave. Engineer or architect not selected.

Wis., Milwaukee—The Tobin-Sutton Co., 636 Lincoln Ave., is having plans prepared for the construction of a 2 story, 62 x 200 ft. garage on Windlake Ave. Estimated cost $150,000. Tharinger & Bruecker, 496 Cramer St., Archts.

Wis., Watertown—The Otto Biefield Co., 202 North Water St., plans to build a 2 story machine shop. Estimated cost $110,000. Engineer or architect not selected.

Wis., Wisconsin Rapids—The Nash Hardware Co., 2nd St. and Grand Ave., plans to build a sheet metal and machine shop. Estimated cost $80,000. Engineer or architect not selected.